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AMERICAN GAS LIGHT JOURNAL

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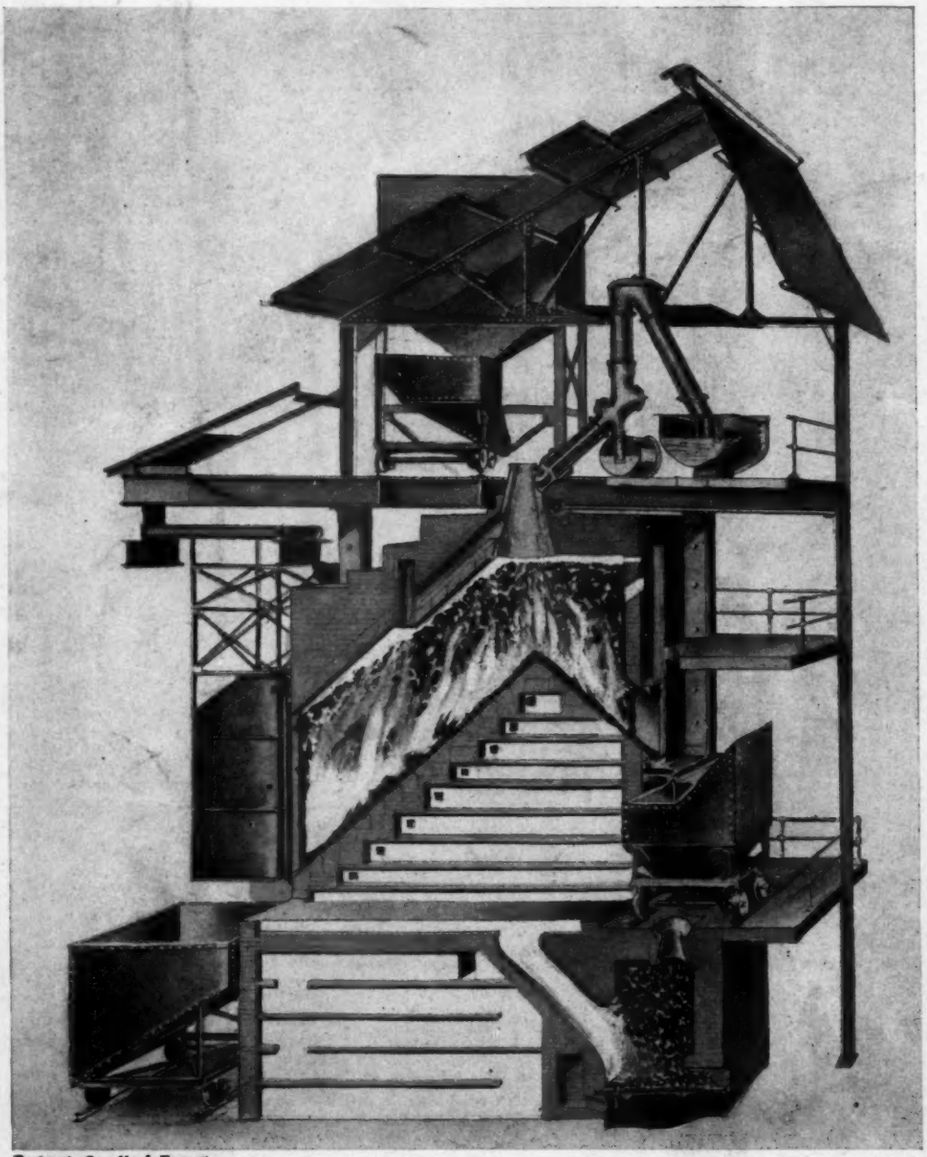
INCLINED COKE OVENS

GREATEST EFFICIENCY



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THE PARKER-RUSSELL MINING & MFG. CO.
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KOPPERS

BY-PRODUCT

COKE AND GAS OVENS

The most efficient method of carbonizing coal is in KOPPERS OVENS and the best coke and by-products are produced by this process.

H. KOPPERS COMPANY

Pittsburgh, Pa.

Builders of

By-Product Coke and Gas Plants
Tar Distilling Plants
Ammonia Recovery Plants
Benzol Recovery Plants

1859 FIFTY-EIGHTH YEAR 1916

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GAS LIGHT JOURNAL

VOL. CV., No. 16. NEW YORK, OCTOBER 16, 1916 WHOLE No. 3,058.

Accurate Diagnosis of Trees Killed by Gas a Most Specialized and Technical Task

Much Larger Number of Trees Suffer from Effects of Escaping Gas than was Formerly the Case—Trees so Poisoned Usually Show Some Characteristic Post-Mortem Symptoms, but Problem of Diagnosis is Greatly Complicated by Fact that Many Similar Symptoms may be Found in Trees Dying from Other Causes

By GEORGE E. STONE

GROUP OF LARGE ELMS KILLED BY BEING SUBJECTED TO GAS LEAKAGE 1½ YEARS

A much larger number of trees suffer from the effects of escaping illuminating gas in the soil than formerly. The increased death rate from this cause may be accounted for by the fact that gas is now more extensively used, and the larger pipes and different types of connections employed, together with the changes in the methods of laying and calking the joints, also play their part; at least there is much less leakage from small pipes having thread joint connections, which have been in the ground for many years, than from larger pipes calked with oakum and cement or lead.

Electric cars, steam rollers, motor trucks and other heavy traffic on highways are often responsible for defective joints and the consequent leakage of gas, especially in newly installed lines. Also the continual undermining of gas conduits made necessary by the construction of sewer and water lines, as well as the effects of frost in very cold winters, cause leakage, and finally the wires, steel rails, etc., carrying electricity, are a constant source of danger to gas pipes, as is occasionally proved by cases of electrolysis. In this way one public service corporation is often responsible for the damage done by another, and, as much of the property of public utility companies is located in the public highways, municipal agents and others frequently show little regard for property rights, hence, damage of a more or less serious nature often occurs to pipe lines which they are not directly responsible for. It should be stated in justice to the large gas producers that every effort is usually made to prevent leakage and injury to trees. Shallow laid lines appear to be more susceptible to leakage than deeper laid lines, and, doubtless, much trouble can be obviated by the use of deeper trenches. The larger pipes, which are more difficult to keep tight, furnish better facilities to patrons; nevertheless the danger from leakage is greater. There are numerous connections in gas mains from which the leakage is slight, perhaps only a few cubic feet a day, while in others it is very great. Even small leaks, if neglected, will injure trees in the course of time, owing to the gradual saturation of the soil with gas.

Illuminating Gas Contains Many Substances Toxic to Plants

Illuminating gas is an extremely complex chemical substance and contains many substances toxic to plants. The poisonous properties are largely confined to the numerous products which are contained in the soil and which are absorbed in small quantities by the soil moisture, they being taken up by the roots and translocated through the tissue. The reactions to these various complex chemical substances are not quite the same in different locations nor in different species of trees. Trees poisoned by illuminating gas usually show some characteristic postmortem symptoms, but the problem of diagnosis is greatly complicated by the fact that many of these symptoms may be found in trees dying from other causes. More or less rapid deterioration and increased brittleness of the wood are quite characteristic symptoms, however.

In summer, the first effects of gas poisoning may be seen in the foliage. The leaves often turn yellow and drop off, while in other cases the leaves will fall when still green, and again the leaves will turn a reddish brown and die without falling. The upper part of the tree, being far from the source of water supply, usually shows the effects of defoliation first. These various symptoms occur before there is any evidence of abnormal tissue above ground. But after the water in the soil containing the poisonous gas principles has passed up through the roots and stems, the wood and cambium bark become abnormal. The first symptoms take the form of a characteristic dryness of the cambium and other tissues outside the wood, this being the first indication of the approaching death of the tissues. Later these tissues—cambium phloem and cortex—turn brown and disintegration follows. The roots which first absorb the poison are naturally the first to become abnormal, but later, as absorption and translocation proceeds the poisonous constituents may be detected in the wood, at the base of the tree. It not infrequently happens that the tissue here is dead, while that in the trunk a few feet above is alive, but this condition does not endure, the whole tree sooner or later becoming affected. When the underlying tissues die the tissue tensions are destroyed and the bark changes color, gradually growing darker, and its physical properties become greatly changed. Soon various species of fungi such as Polystictus, Schizophyllum and others, find a foothold on the bark, and borers and other insects attack the dead tissue. Even bacteria and molds, like Penicillium, become active and hasten the process of disintegration. The smaller twigs become dry and brittle, and the ends often break off. The upper limbs usually lose their bark first, but eventually the larger limbs present the same appearance. Disintegration may take place so rapidly that in one and a half to three years the bark disappears and most of the larger branches will break off, and soon nothing but a portion of the trunk and a few stubs remain.

Similar Symptoms May Be Found in Trees Dying From Other Causes

It must be understood that many of the symptoms mentioned above may also be found in trees dying from other causes and do not necessarily constitute reliable guides to the detection of gas injury. The tissue furnishes the best symptoms for diagnosis, and the writer, who has for the past twenty years been examining hundreds of trees killed by gas, from the first found it necessary to make a thorough examination of the tissue to warrant any degree of accuracy in the diagnosis. In diagnosing gas injury one must learn to detect either by chemical means or from direct observations and experience, the presence of the poisonous constituents of illuminating gas which are absorbed by the roots and circulate to a certain extent through the tissues of the wood.

As already intimated, no two species of trees suffering from gas poisoning present precisely the same symptoms, and there is much difference exhibited even in the same species. The location, season of the year and other factors having an important modifying effect.

Trees, for example, when examined in the fall, will show slightly different symptoms from those presented in the spring. This is also true of trees poisoned by gas from different manufacturing plants, which varies considerably.

The variation in the chemical constituents of the soil here and there may to a certain extent account for the variations in the reaction of gas on the tissues, but this factor is probably not very important, since these variations in the soil are likely to be found even in a single town supplied with gas from one source, and, as a rule, the symptoms of trees injured by gas from a single manufacturing plant are alike.

Tables giving the results of gas analysis from various corporations, however, show that there is considerable difference in the composition of gas, and that gas from a single establishment is likely to vary slightly from day to day, not only in the percentages of carbon monoxide and hydrogen, but in the other products.

Trees Killed By Gas Always Possess Peculiar Characteristic Odors

The odor and color of the tissues should first be examined carefully when diagnosing a gas injured tree, although it is possible by the use of chemicals to obtain reactions and to detect certain products in the tissue. There are different odors associated with the wood of trees which die from various causes, and it is therefore necessary to become familiar with these before relying too closely on this factor. For instance, molds and other microorganisms found in the sap of trees dying from various causes often cause decomposition, with resultant odors. But there will always be found in trees killed by gas peculiar characteristic odors difficult to describe, and more easily recognized at least at the base of the tree after it has been dead for a few weeks or months. The odor is more prominent in moist than in dry trees and can be detected in the tissues of the bark as well as of the wood. Sometimes this odoriferous wood is found deep in the sapwood, and can be recognized in the stumps of trees freshly cut, but in old stumps where decay has set in it is not always discernible.

In such cases some part of the root system, if dug up, is likely to give a characteristic odor except when the wood has become too dry and a more or less advanced stage of decay has set in. Even the rate of disintegration and the nature of the decay are often characteristic, and are of some value in diagnosis.

It should be remembered that the odors of different species of trees even when in normal condition differ greatly; *i. e.*, the natural odor of the maple is quite different from that of the elm, horsechestnut or red oak, and their products of decomposition also differ.

The accurate diagnosis of trees killed by illuminating gas is one of the most specialized and technical tasks. Nevertheless the characteristic odors given to the tissue by illuminating gas can be discerned quite accurately by one thoroughly familiar with them.

Sometimes these odors are found in all of the tissues of the trunk, but more often they are confined to some special part of the tree or root. They are more pronounced by far at the base of the tree, and rarely found in the top. Caroline poplars and willows often display peculiar reactions to gas poisoning.

The bark splits open and large masses of soft, parenchymous tissue are formed directly from the cambium layer. When the tree dies this parenchymous tissue decomposes into a mucilaginous mass.

Some Species of Trees Less Often Affected Than Others

Some species appear to be less often affected by gas poisoning than others. It is a question whether there is much difference in susceptibility, however, as regards species.

Trees like the elm and maple, with a large spread of the roots, naturally become poisoned if located near gas leaks, and some trees are adapted to more strenuous conditions, and possess a greater capacity for regeneration than others, although they may be as susceptible to poisoning as trees of other species. Coniferous trees possess the greatest resistance to gas poisoning of any species, and in many instances they have been observed surviving in an apparently healthy condition when located dangerously near broken mains, while deciduous trees located much farther away would always succumb. In some cases where conifers have actually been poisoned they have continued to live. This response may in part be explained by the protection furnished by the coating of micorhiza on fungus growths common to the roots of conifers.

We know of no remedies which can be applied to trees already poisoned by gas, since the injury occurs below the surface of the ground, and the effects are seldom noticeable until the poisoning is more or less pronounced.

If the leakage of gas could be discovered quickly and the leak repaired, the effects on the roots might be prevented, but this is rarely the case.

Illuminating gas in small quantities acts as a stimulus to plants, and there is a certain capacity for adaptation to poisons possessed by them, although limited. By the time the effect appears in the foliage considerable gas has been absorbed by the roots, and since it is impossible to eliminate the gas from the soil, absorption is bound to continue, and the tree is doomed.

We have known of only a few instances in which trees have shown even slight symptoms of gas poisoning and survived for any length of time with the exception of the conifers above noted. In some instances where only one root has been affected, and the poison has not reached the trunk of the tree, amputation of the root may prevent further injury and is known to have been effective in some cases. There are many cases in which trees have not suffered from gas poisoning although located near large leaks owing to the amputation, during the installation of curbings, etc., of the larger roots which extended over the gas pipes.

DIGGING UP AND AERATING OFTEN BENEFICIAL

When the soil is charged with gas, digging it up and aerating it are beneficial, and in the case of severe leakage it is well to leave the trench open for a few days, if possible. On the other hand, boring holes in the soil and filling the same with water, lime, etc., is a perfectly useless practice. It is generally believed that if young trees are planted near others which have died from gas poisoning, they will not live, but this is true only in some cases. If the soil is thoroughly saturated with gas, bad results will follow, but if the trees are planted in fresh loam and the old soil aerated, there is little likelihood of the tree dying.

Gas escaping into the soil from a leak follows the line of least resistance. For this reason, if leakage occurs in the street in front of a house, one can often detect the odor of gas in the cellar, as the gas will follow the exterior of the pipes leading into the cellar, and it often escapes into sewers, underground conduits, hydrants, etc. Wells are often badly contaminated even when located some distance away, and in the winter gas leakage becomes a source of danger to nearby greenhouses.

There is considerable difference in the resistance of soils to gas. In gravelly soils we have known gas to travel 2,000 ft. when the ground was frozen, and escape into the cellar of a house, while in heavier soils it is more likely to be restricted to small areas. It requires a considerable amount of gas to kill a large tree, although not so much as it would were it not confined so closely by the soil covers, especially in winter, and by the impenetrable macadam and other style of modern roadbeds.

Temperature, Relative Moisture and Movement of Air Essential Features in Ventilation of Rooms

The ventilation in rooms is not essentially a matter of correcting diminished oxygen or increased carbon dioxide but of keeping the temperature, the relative moisture, and the movement of the air in a proper state, declare G. A. Burrel, I. W. Robertson and C. G. Oberfell in a paper prepared for the U. S. Bureau of Mines. However, in the ventilation of rooms where people congregate the carbon dioxide and the oxygen tests may be excellent criterions of the state of ventilation.

Haldane and Osborne have investigated the ventilation of a large number of workshops and factories and have recommended that the standard of ventilation be such that the proportion of carbon dioxide does not exceed 0.12 per cent during daylight or 0.20 per cent after dark when oil or gas is used for lighting.

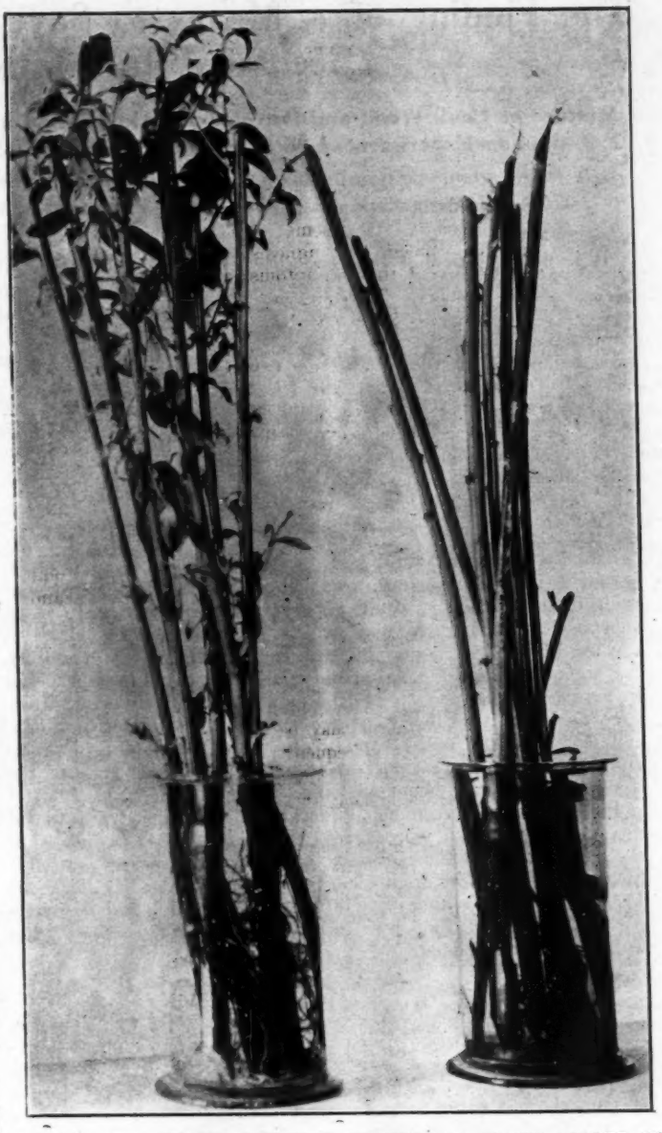
The carbon dioxide percentage is specified because its determination is easy and its presence a sign that there is no free ventilation and that the air tends to become humid and warm.

However, the vitiation of air in overcrowded rooms may arise from the products of disease, want of cleanliness of the occupants, or the room itself. In fact, air that, judged by the carbon dioxide standard, is sufficiently pure, may be exceedingly impure when judged by the number of micro-organisms in it, and vice versa.

The test of smell, of feeling of comfort or discomfort, in breathing the air of a room may give results equally at variance with the carbonic acid test.

Some people are more influenced by odor, others by an increased quantity of carbon dioxide or moisture or an increased temperature.

Men who habitually work in bad air that is not sufficiently tainted to cause acute symptoms may suffer from slight anæmia, with disinclination for work, rapid breathing on exertion, lassitude, loss of appetite, and other symptoms of indigestion. Return to work in better air, however, soon puts them right.



EFFECT ON WILLOW CUTTINGS GROWING IN WATER—WATER IN VASE TO RIGHT CHARGED WITH GAS

Publicity a Factor in Efficiency Engineering

A principle of efficiency engineering which has not been sufficiently dwelt upon in the publications relating to the subject is that of publicity, asserted Elmon L. Hall, chief engineer of the Portland Gas & Coke Company, of Portland, Ore., in a paper read before the Pacific Coast Gas Association at its recent annual convention.

There is nothing like emulation to secure results. The results secured by personnel should be frequently given out at efficiency meetings in order that individuals may realize for themselves the quality of their work.

It frequently happens that even prior to making efficiency studies a marked and spontaneous improvement will take place.

Care should be taken that the comparisons are made under similar conditions. An employee should always be given full opportunity to point out abnormal conditions, which should be accepted with liberality, thus creating an atmosphere of mutual confidence.

It frequently happens that the very inefficient anticipate their dismissal thus saving the embarrassment of weeding them out.

On the other hand it should be very distinctly understood that efficiency comparisons alone should not afford the only means of judging employees. There are many valuable characteristics and qualities which may not be reduced to such terms, and it should be appreciated by all that these other considerations are always considered before taking action in the case of any employee.

The Finding of a Means to Save Coal in the Production of Gas has Become Vital Matter in Many Countries

Mixture of Coal, Wood and Petroleum Residue Tried in Important Russian Works—Residues from Olive Oil Production Experimented with in South of France—Mixture of Coal and Wood Used with Moderately Good Results in South America

BY A SPECIAL CORRESPONDENT

It is quite clear that the possibility of carbonizing such substances as wood, peat, and manure in lieu of coal, which has from time to time received attention, is a problem to which a good deal of significance is attached at the present time owing to the difficulty experienced by some foreign gas companies in obtaining supplies of suitable gas coal.

In some of the South American works a mixture of wood and coal has been used with moderately good results for some time past, but its success is largely dependent upon the class of timber available and the character of the demand for gas; that is, whether it is chiefly for lighting or for heating purposes.

French Investigations

The French Society of Gas Engineers, at its meeting in July, issued a report on certain coal substitutes, but as a result of their investigations, it would appear that at present there is no substance by which coal may satisfactorily be replaced, although the use of wood, etc., may be serviceable locally, and for a time.

The employment of wood alone, moreover, is sure to be followed by trouble, in that the gas evolved is of a particularly acid nature, with the result that the iron-work suffers severely from corrosion.

When wood and coal are mixed, however, the alkaline products from the latter prove sufficient to neutralize the acids from the wood, and no derangement is found.

In Algeria it is common practice to distil eucalyptus wood mixed with about 20 per cent of coal. This wood, which is of the white, and not the red, variety, is cut into blocks about four inches square. After distillation for two hours it will yield about 11,650 cu. ft. of a somewhat inferior gas per ton, and the charcoal residue obtained amounts to about one-quarter of the original weight of wood treated.

Mixture Adopted in Russia

Since the beginning of the war, according to a writer in the London *Times*, a works of importance in Russia has adopted somewhat novel means of overcoming the coal shortage. In this case the raw substance carbonized consists of a mixture of coal, wood, and mazout, the last being a residue obtained from petroleum. When the mixture consists of 35 per cent of coal, 64 per cent of wood, and 1 per cent of oil residue, the yield of gas amounts to about 22 per cent of the total products obtained, while coke accounts for 60 per cent and charcoal for 15 per cent. The greater portion of the charcoal may be readily separated from the coke by hand picking.

In Bavaria and Switzerland, wood gas was in regular use some years ago, and was popularly known as Pettenkofer gas. In these countries it was found that up to 14,000 cu. ft. of gas could be obtained from a ton of pine, but the gas contained as much as 25 per cent of carbon dioxide, which had necessarily to be removed by means of lime. The ultimate product yielded contained nearly 8 per cent of unsaturated hydrocarbons, and was conspicuous from the point of view of illuminating power. The by-products consisted of about 20 per cent of charcoal and 5 to 7 per cent of tar of good quality.

Resins From Certain Pine Trees

The French committee speaks highly of the use of resins obtained from the tapping of certain pine trees. This gum-like material is collected and strained, and may then be carbonized with or without admixture with coal or any other substance. As would be expected distillation takes place very rapidly and results in a gas of exceptionally high candle power, while practically no solid residue remains behind. The scarcity of the material, however, and its cost (about $30 per ton) precludes its adoption on a large scale.

In the south of France experiments have been conducted with the residues from the production of olive oil. The pulp of the fruit, after squeezing, is used direct, and yields over 40 per cent of its weight in gas. The solid residue consists of charcoal powder, which is mixed with tar and employed in the manufacture of briquettes.

The chief drawback to carbonizing wood and such materials in conjunction with coal is the change which is found in the density of the gas. Wood gas is invariably of greater specific gravity than neat coal gas, hence its adoption must be followed by the wholesale adjustment of burners and other appliances.

Advocates Commodity Gas Rates

S. Waldo Coleman Declares that Wonderful Development of American Railway is Due to Differentiation of Rates Based on Value of Service—Proposes that Gas Industry Adopt Railway Methods to Its Own Uses

The wonderful development of the American railway with its cheap service is due to this differentiation of rates largely based on value-of-service, asserted S. Waldo Coleman, manager of the Coast Counties Light & Power Company, of San Francisco, Cal., in a paper presented before the Pacific Coast Gas Association at its recent annual convention. As in the railroad business every piece of freight does not carry a proportionate part of the overhead expense, so, in the gas business, all uses of gas should not have to bear a proportionate part of the overhead.

Of course, no low rate can be made for a particular use of gas unless that rate is sufficient to fully cover the additional cost of supplying that gas, or, in railroad parlance, cover the "out-of-pocket" cost of supplying that gas, and, as in the case of the railroads, the surplus, however small, obtained from such gas business, will lessen by just that amount the profit which must be made from the other consumers in order that a reasonable rate of return may be made on the investment.

Tariffs Not What They Ought to be But What They Must Be

There is no more reason why 10,000 cu. ft. of gas used for heating must be sold at the same price as for cooking, than that the freight rate on soft coal must be the same as on the anthracite coal. There have been a few rates made by gas companies based on the use of the product, but a great deal more should be made. Take the case of the small companies whose average cost, including interest and depreciation, is from $1 to $1.25 per 1,000 cu. ft., and who have graduated scales running down to 80 cents per 1,000 cu. ft. based purely on quantity; they invariably have extra gas making capacity.

The cost of the additional gas which can be made would average from 30 cents to 40 cents. Any gas which can be sold at a rate above this additional cost, is lowering by just that amount the amount which must be paid by others.

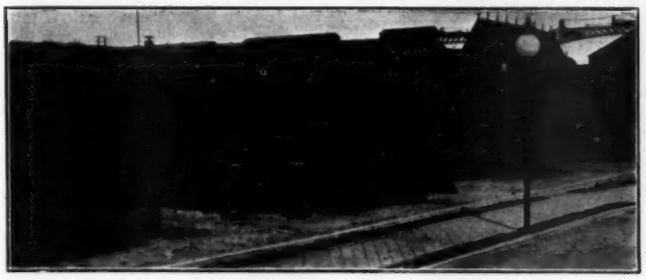
In practice, a sufficient margin, of course, would be given to allow for interest on any new construction which may reasonably follow.

There is a large amount of gas business which can be obtained if we are willing to make the prices based on this additional cost of service, instead of insisting that all consumers should bear the same proportionate part of the cost of the gas. This is true in railroads, as shown by a witness before the United States Industrial Commission when he stated "A freight tariff is made as it is, not because it *ought* to be that, but because it *must* be that."

In truly competitive business a reasonable rate is what the traffic will bear, because, if the rate is above that, the traffic won't move. In much of the gas business in competition with wood, oil or coal, it is the competition feature—what the traffic-will-bear standard—that determines the rate if gas is to be sold, and not the cost of service, because, if the gas cannot compete, the consumer will get along with some other fuel.

Area Theory for Calculating Amount of Oxide to Purify Given Quantity of Gas Practically Disproved by California Tower Purifiers of Recent Years

E. S. Jones Asserts that These, Carrying as They Do, Beds of from 10 to 15 Ft. with Comparatively Small Area Prove that the Limit to the Depth of a Bed of Oxide is Dependent Only Upon the Back Pressure—Discusses Purifying Methods in Use on Pacific Coast



WOODEN PURIFIERS WITH 4-30 FT. BY 30 FT.-WATER LUTE BOXES IN DISTANCE

Purification has been refined from an elaborate and expensive operation to a simple and comparatively inexpensive part of the gas making, declared E. S. Jones, engineer of the gas department of the Pacific Gas & Electric Company, of Sacramento, Cal., in a paper presented at the recent annual convention of the Pacific Coast Gas Association at Santa Barbara.

Use of Lime for Purification in California Has Been Abandoned in Favor of Oxide of Iron

In California, since the use of lime for purification has been abandoned, oxide of iron has taken its place, and, on account of long hauls and heavy freight rates it was more economical to make oxide than to buy it.

Improvement in the manufacture of oxide has been neglected, to a certain extent, on the Pacific Coast, due to the small amount of sulphur in the California oils as compared with Eastern and and foreign coals, this sulphur content running from nothing to 4 per cent. The average sulphur in the oils from the five largest

MIXING OF COPPERAS DONE BY CONCRETE MIXER

fields of the San Joaquin Valley is 0.89 of 1 per cent. Under these conditions almost anything in the way of oxide will show good results and have a long life.

Early Oxide Made From Imported Copperas

Early oxide was made from copperas imported into this country duty free. Then an ad valorem tax was placed on it, by different administrations, ranging from 35 per cent to 45 per cent. The Payne tariff of 1909, fixed a straight duty of 15/100 cents per pound. The new tariff of 1912 places this commodity again on the free list, which may (after the war) have the effect of again reducing the price in this country. The ad valorem duties had the desired effect, and American chemical companies began making copperas in large quantities.

Copperas or green vitriol, is the ferrous sulphate of commerce,

TOPS OF JONES WOODEN PURIFIERS SHOWING WATER FOR CIRCULATION BETWEEN STAVES

occurring in pale green crystals by dissolving scrap iron in dilute sulphuric acid, having the chemical formula of $FeSO_4 \div 7H_2O$.

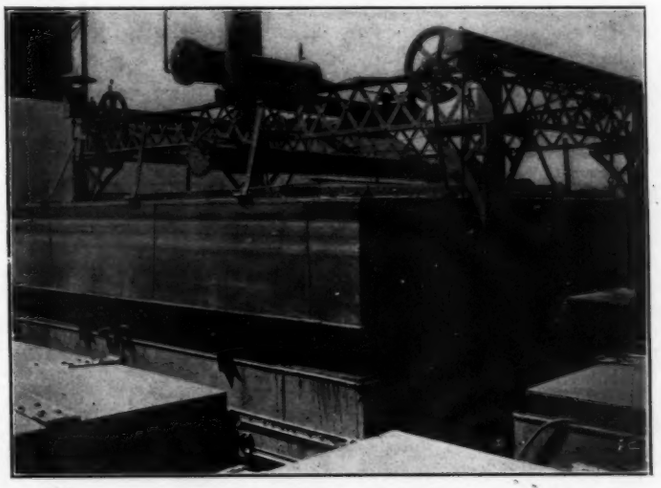
This copperas, with a commercial value of from $12 to $16 a ton, having a class "D" freight rate together with locally burnt lime at a price of $1.35 a barrel, which is about $12 a ton, mixed with fine pine shavings as a vehicle, makes an ideal oxide. Several different materials have been used in the latter capacity, some of which with their weight per cubic foot are,

Pine shavings	4.2 lb.
Pine sawdust	10.2 lb.
Ground cork	4.8 lb.
Ground corn cobs	12.0 lb.

Pine shavings and sawdust are commonly used on the Pacific Coast, because they are plentiful and free from acid, or, if slightly acid, easily neutralized with lime. Shavings are preferable to sawdust, the latter having a tendency to pack, especially when used with an hydrated oxide, and as the sulphur content of the oxide increases, it becomes so dense, that the increased back pressure necessitates frequent turning or spading of the oxide. The voids offered by the shavings allow space for this, and the decreased amount of surface for contact with the gas is more than offset by the saving in labor.

Increase in Volume of Oxide

This increase in the volume of the oxide due to the absorbing of sulphur is clearly shown by the following figures. A cubic foot of sulphur weighs about 127 lb. If the completely fouled oxide contains 64 per cent, by weight, of sulphur, for every cubic foot of oxide we will have an increase in volume of 368 cu. in..



WATER LUTE PURIFIER WITH LID RAISED FOR REVIVIFICATION BY SUCTION BLOWER

which is over 21 per cent of the volume of the original cubic foot, but seldom do we have a noticeable increase in the volume of oxide in the box. This value of shavings is especially true since deep beds and revivification "in situ" have become the practice.

Most gas works are in close proximity to a lumber mill and shavings may be obtained, if not free, at a very small cost.

Mixing of Copperas, Lime and Shavings

The mixing of copperas, lime and shavings makes a precipitated, hydrated ferric oxide; the shavings being the vehicle, and the lime and copperas react metathetically on each other forming a ferrous oxide which is oxidized in the air to ferric oxide.

Ferrous Sulphate weighing 555.92 lb. requires 148.20 lb. of Calcium Hydroxide and makes 159.80 lb. of Ferric oxide or 0.2665 lb. $Ca(OH)_2$ for 1 lb. of $FeSO_4$ and 0.9274 lb. of $Ca(OH)_2$ to make 1 lb. Fe_2O_3. This produces a purifying material containing 0.316 per cent of Fe_2O_3. This, however, is often increased by the addition of iron rust.

Old Method of Mixing

Formerly the method of mixing was to spread the shavings about 6 in. deep on the floor, throwing the lime on from buckets by hand; the quick lime to be slaked in open barrels, (in an excess of water to prevent overheating and thereby ruining the caustic properties), to the consistency of cream.

The shavings were then turned by means of shovels until thoroughly coated with lime. After the batch had been entirely limed it was again spread on the floor and the copperas liquor thrown on; the copperas in the form of crystals having been previously melted in open end barrels containing a steam jet, the heat of the steam with slight condensation being enough to melt the copperas due to its large water of hydration content. After this several turnings were necessary to thoroughly coat the limed shavings with the green copperas liquor. After this, iron rust was added and turned in with the copperas. It was then advisable to spread the mass as thin as possible on the floor.

The oxidation of the surface will take place almost immediately for two or three inches in depth, changing the color from a dull dark green to a reddish brown. It must then be turned several times or until the entire mass is of this same color. It is only necessary again to turn, if in danger of firing through overheating. When dry, the color will be a golden brown and will have a velvety feeling. This is one of the best tests for perfect physical condition.

Different Formulas Tried

Several different formulas have been tried and all discarded in favor of one given the writer by E. S. Jones, over ten years ago, which is the above method of handling the following amounts:

Copperas in lump	1 bbl.	225 lb.
Dry lime	¼ bbl.	56 lb.
Shavings	2 bbl.	60 lb.
Iron rust		10 lb.

The size of the barrel used is the lime or cement barrel and the above amount will make about 12 cu. ft. The cost of 2,100 cu. ft. made by this method in 1913, was $861.14 or $0.41 per cubic foot.

In 1915, 7,378 cu. ft. of oxide was made, in an improved way, the same formula being used.

A large concrete mixer was purchased at a cost of $750—operated by a 6 hp. engine.

A good sized trough 12 ft. long, lined with 1 in. steam pipes and capable of liquifying a ton of copperas at a time was installed, also improved facilities for handling and slaking lime. The mixer handled 14 cu. ft at a time and proved very thorough in the mixing.

The materials and cost of this batch were—

Shavings 1,589 bbls., 34,958 lbs.	Free	Per Cu. Ft.
Copperas, 133,400 lbs. @ $0.70 per C	$933.80	$0.1265
Lime, 149 bbls. @ $1.35 per bbl	201.15	0.0272
Freight on copperas, $0.095 per C, including switching on two cars	131.73	0.0178
Labor mixing, unloading copperas, incidentals such as gasoline, shovels, gloves, buckets, etc.	175.72	0.0238
7,378 cu. ft.	$1,442.40	$0.1953

Addition of Iron Rust Good Practice

The addition of iron rust to increase the ferric oxide value is good practice if handled properly. Borings, preferably cast iron, free from oil or dirt, should be spread out thin on the floor and sal ammoniac in solution added, turning every day to break up the lumps and allow complete oxidation. These should then be screened through a fine mesh screen at least a 16 mesh, the remainder being again rusted. This method safely assures the absence of free iron in the oxide. This is important as the Carbon Monoxide in the gas reacts readily with the free iron to form an Iron Carbonyl $Fe(CO)5$, which is a volatile liquid that is decomposed by the heat at the burner and clogs up the openings and screens and ruins mantles.

A number of plants have found it economical to use, and are using to-day, an iron sponge made by rusting iron borings and mixing with wood shavings, previously wet. A good formula for this oxide is 20 lb. of borings to a cubic foot of shavings. From personal investigation the writer has found the cost in labor turning this sponge to more than offset the cost of the copperas in the precipitated oxide.

Essentials of Purifying

The first essential in purifying is to keep the material clean in the boxes, free from tar and oily vapors by thoroughly scrubbing and condensing the gas. A very thin layer of tar on the bottom of the oxide will often entirely stop the reaction on Hydrogen Sulphide, besides causing extreme back pressure and necessitating the complete turning of the oxide. It is this turning and handling of the material before its final fouling that increases the cost of purification.

Oxide carefully made and handled may be put into a box and not removed or even turned until it has completely fouled; containing 65 per cent sulphur, which is the practical life of the oxide. This, of course, embodies the method of revivification without removing the oxide from the box, by either the admission of air at the purifier inlet or by cutting out a box and drawing air down through the material.

The former method under certain conditions is entirely satisfactory with one exception; namely, the necessary large amount of Nitrogen that is admitted decreasing the value of the gas or necessitating the manufacture of a richer gas to take care of this inert nitrogen.

The conditions governing the satisfactory admission of from 2 to 3 per cent of air with the gas would necessarily be a set of boxes in series where the last box would not be called upon to do any work, as a peculiarity of this form of revivification is that the two reactions will not take place at the same time; that is, the reaction of the ferric oxide with sulphuretted hydrogen and the ferric sulphide with oxygen.

Byron E. Chollar based his reversal principle on this law. By reversing the flow through the series of boxes the oxygen revivifies the foul box, which is the last. Under these conditions, he claims, the hydrogen sulphide attacks the ferric oxide to form ferrous sulphide and ferrous oxide; the ferrous sulphide is immediately converted into ferrous oxide and free sulphur. The ferrous oxide is then in position to be easily made ferric oxide when the reversal of flow takes place. If the nitrogen is objectionable, as already mentioned, revivification may be handled satisfactorily by the latter method of cutting out the foul box and drawing air downward through the oxide by means of a steam jet exhauster, or, preferably, a suction fan type exhauster, the connections to be as large as possible and located in the center of the boxes.

Air should never be blown up through a box to be revivified, but always drawn downward as this reaction involves considerable heat, especially at the beginning and at the nearest point to the incoming air, if blowing through, great danger exists of the grids and oxide catching fire without warning.

Advantages of Drawing Air Downward

If drawn downward, the top of the oxide can be watched and the revivifying fan shut off if excessive heating is shown. The oxide will not fire when wet nor will it revivify. Therefore water should not be put on the foul oxide to be revivified unless actual firing or danger of firing exists. When thoroughly revivified it is good practice to wet down the oxide as the reaction with Hydrogen Sulphide will not take place with the hydrated oxide when

in an anhydrous state and the extra water helps the water vapor in the gas to produce the desired condition.

It is necessary for the oxide to be always in an alkaline state, and frequent testing for this may save trouble as a slightly acid condition will cause the oxide to act sluggishly and often stop the reaction with Hydrogen Sulphide entirely. A simple method of testing is to obtain an average sample of the oxide in a large glass beaker and mix with distilled water. After stirring thoroughly drop in a piece of blue litmus paper. This will turn red if acid is present. If an acid reaction is shown the oxide should be wet down with a milk of lime, or, if in a coal gas works, a small amount of ammoniacal liquor will have the desired effect.

In revivifying a series of boxes, where air is not mixed with the gas, it is good practice to revivify *with* the flow of gas; that is, when a box is cut out for revivifying it is the one that has been acting as number one or the one most foul, and the box that has been number two is made number one and so on.

Revivifying Should Be Done as Often as Convenient

This revivifying should be done as often as convenient. A first box will always absorb a large percentage of the Hydrogen Sulphide; that is, it will generally absorb 180 out of 200 grains in the crude gas as readily as 150 out of 170 grains in the crude gas. When it begins to show a falling off in its absorbing powers, the box should be cut out and revivified, when revivification will be rapid and complete in a very short time with a minimum danger of overheating, while if the box is allowed to remain in action as number one until reaction with Hydrogen Sulphide stops, revivification will be extremely slow and great danger of firing exists, which may ruin the grids or shavings, and, at least, will entail labor in turning.

When the oxide has absorbed up to 30 per cent of Sulphur, revivification takes place more slowly with very little danger of excessive heating. Often it is necessary to start the reaction by heating it slightly by introducing steam under the trays and the higher the temperature the more active the revivification.

Area Theory Practically Disproved

Much has been written on the necessary amount of oxide to purify a given quantity of gas, nearly all results being based on the area in square feet and none taking into consideration the amount of Hydrogen Sulphide in the crude gas. The area theory has practically been disproved by our power purifiers of recent years, carrying beds of from ten to fifteen feet with comparatively small area. This reduces the figures for oxide quantity from square feet to cubic feet and proves that the limit to the depth of a bed of oxide is only dependent on the back pressure.

Probably all are familiar with the rule: Volume of oxide between inlet and outlet of series should be 1/20 of rate per hour. This checks up very closely with actual conditions, but the writer has always been under the impression that the difference between, say 150 grains and 450 grains of hydrogen sulphide in the raw gas should call for some difference in the volume of oxide; especially if oxide is to be revivified "in situ." Therefore the rule: Maximum rate of flow per hour times Grains Hydrogen Sulphide per hundred cubic feet, divided by 4,000 would give equal conditions for purification as well as revivification for the plant having 450 grains with the plant having only 150 grains in the raw gas.

Simple Method of Testing Batch of Oxide

A simple and convenient method of testing a batch of newly made or purchased oxide for its Hydrogen Sulphide absorbing powers, as well as the last word as to the value of the oxide in this respect, is to take about 12 ounces of the material, and place it in the glass purifier as shown in the accompanying illustration (for this purpose the writer uses the well known condenser of the "Referees" total sulphur apparatus with the marbles removed) and pass unpurified gas through it until the oxide is completely fouled. If unpurified gas is not convenient, black lump ferrous sulphide and sulphuric acid in a large mouthed bottle will make a good Hydrogen Sulphide generator. When completely fouled, remove the oxide and allow it to revivify until the black sulphide has entirely disappeared when 250 grains should be set aside for testing for quantity of free sulphur as shown later. This complete fouling and sampling should be done at least four times when the results will give sufficient proof of what can be expected from the oxide on a larger scale.

Six foulings of a precipitated oxide with the above method showed the following results.

	Per Cent of Sulphur.
First fouling	18.0
Second fouling	32.6
Third fouling	43.4
Fourth fouling	51.8
Fifth fouling	59.3
Sixth fouling	66.6

By means of the atomic weights we find the theoretical amount of Hydrogen Sulphide that can be taken up by oxide, containing different percentages of Fe_2O_3 in one fouling.

Neglecting water we have:

$Fe_2O_3 + 3\ H_2S =$

$Fe_2S_3 + 3H_2O$

$159.08 + 102 = 207.8 + 54$

159.8 lb. Fe_2O_3 requires 102 lb. H_2S to form Fe_2S_3 or 2FeS S.

Hence 1 lb. Fe_2O_3 requires 102 lb. H_2S or 0.6383 lb.

$$\frac{}{159.8}$$

H_2S for each lb. of Fe_2O_3.

One cubic foot of oxide weighs 41 lb. and Fe_2O_3 is present by weight to 10 per cent that cubic foot of oxide would contain 4.1 lb. Fe_2O_3 and could absorb 4.1 x 0.6383 lb. = 2.617 lb. of Hydrogen Sulphide.

Per cent Fe_2O_3 present	lb. Fe_2O_3 present	Theoretical amount of H2S required to saturate.
10	4.1	4.1 x 0.6383 = 2.617 lb.
20	8.2	8.2 x 0.6383 = 5.234 lb.
30	12.3	12.3 x 0.6383 = 7.851 lb.
40	16.4	16.4 x 0.6383 =10.468 lb.
50	20.5	20.5 x 0.6383 =13.085 lb.
60	24.6	24.6 x 0.6383 =15.702 lb.

Another important test for oxide is that for the amount of Sulphide present the writer has found the following to be very simple and invariably accurate to within 0.5 of one per cent.

Take an average sample of the oxide to be tested, in a large beaker, weigh out 250 grains and add to this 250 cc. of carbon disulphide in a weighed beaker and allow it to evaporate to dryness; the weight of the residue in grains is the percentage of sulphur in the oxide. Since only the free sulphur is dissolved it is necessary to be sure that the oxide is thoroughly revived before weighing the sample, also that the sample is dry and free from its water of hydration. This can be accomplished by setting the sample in the sun for a few hours, when it will both revive and dry, if laboratory apparatus for this purpose is not handy.

Test of Oxide for Its Iron Content

The test of oxide for its iron or ferric oxide content is a little more complicated, but with ordinary laboratory equipment very good results may be obtained by the following:

Weigh into a silica dish 2 grams of the oxide, burn over a bunsen flame till all carbon is gone, transfer to a beaker and dissolve with hydrochloric acid and a little nitric acid. Precipitate with ammonium hydroxide—filter—wash, ignite, precipitate in silica crucible and weigh as Fe_2O_3.

From the foregoing description it will be seen that a very efficient precipitated oxide may be made from copperas, by means of mechanical mixers and handlers, at an extremely low cost.

The efficiency of the oxide depends largely on its physical condition, and by careful treatment and frequent testing it may be revivified in position and made to absorb fully 65 per cent, by weight, of sulphur without the necessity of removing from the box. The purification capacity is not dependent on area but quantity, thereby reducing the necessary outlay in capital as well as ground space, giving maximum purification capacity at minimum cost for installation.

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The Difference

As the American Gas Institute meets this year in its annual convention, the industry as a whole presents a much different aspect than it did a year ago. Then the air was permeated with gloom. The high cost of materials was the prevailing thought and anxiety. To-day, materials cost as high, if not higher, and the labor situation has become even more acute. But the spirit of gloom has been dispelled. Optimism and cheerfulness prevail.

The reason is evident. The industry has, to a large extent, adapted itself to the new conditions. Rates have gone up no higher—in fact there have been many reductions—yet the prospects are of the brightest. The industry has found new markets and new uses for its product and by-products, and all recognize that the surface of the great development possibilities that exist have merely been scratched. In a period when, after a brief, flickering moment of prosperity in the general construction field, developments have already commenced to lag, manufacturers of gas making equipment and machinery are, if anything, complaining of being rushed beyond reason. New plants are being built, extensions are being made to old. And this, at a time when in the electrical field construction has practically come to a stand-still.

Who, then, can say, in the face of all this, that the gas industry is dead, that its personnel is incapable of grasping at the opportunities that present themselves? Who can say that the future for gas is not of the brightest?

To those members of the American Gas Institute who gather to-day in Chicago, the AMERICAN GAS LIGHT JOURNAL extends its heartiest best wishes. Truly they meet under the most auspicious circumstances.

Compensation of Employees

The always present problem—compensation of employees—has become more acute than ever during recent months. On all sides the question is heard: On what scale, and in what manner should this or that employee be paid? In the opinion of this journal much valuable mental effort is being wasted over a problem, which, in the final analysis, is very simple of solution.

There is only one proper rate of compensation for any employee; only one basis upon which a rate adapted to securing the maximum efficiency. That rate is the one which will enable him to live comfortably in the manner befitting his class and put a reasonable percentage aside as a provision for old age or a rainy day.

The latter is particularly important. No man works so efficiently as the man who can see from month to month some tangible return for his efforts; who can, at the end of the year, look back and see that he has not merely split even, but that the year has meant something to him; that he has advanced somewhat towards eventual financial independence. Merely making a living is not an incentive to a greater expenditure of effort.

The real problem to be solved is in regard to what constitutes a comfortable living wage for the different classes of employees.

One whose work requires that he should possess a university education, manifestly, would be miserable were he compelled to live in a manner that would seem like paradise to an immigrant just arrived from Europe. It does not matter that this university graduate may be the son of a day laborer and have been brought up in a hovel, and have obtained his education by washing dishes or collecting fares on a trolley car. The environments of his university career, and the conditions of life he has come in contact with during that period, will have spoiled him for the kind of life he has, perhaps, been brought up in. He may, in a pinch, be able to exist as did his father, but he will not be contented, and contentment is essential to efficiency.

A particularly striking example that may be put forward is the salesman. Many of this class have started out as mechanics, or in other of the hardier grades of gas company activity. Some of them, when they are started out on their sales routes, are rather rough diamonds. They know a great deal of the mechanical advantages of the appliances they are selling, but often know little else.

Those who succeed and get along make up for their weakness in English by their knowledge of the product they are handling, and in belief in its value. As they get farther away from the workshop, and its environments, and come in contact with prospects who have had greater educational advantages than they, the rough edges begin to wear off, and we find in a short time men who have gained in a few years the same degree of polish that has taken some a lifetime to acquire.

As they progress their territory increases. From covering a town their field of activity expands to a state or a group of states. They are compelled to travel and to live in hotels. The dignity of the firm they represent requires that they do not do this on too economical a basis. They learn to live high, and, after a few years of getting accustomed to it, high living becomes an essential to their happiness.

Mentally perhaps, and in ability too,—though of a different order—many of their equals can be found in the accounting department, for instance, who could be perfectly happy in home surroundings that these salesmen would find positively dingy. The companies employing them, for good logical, businesslike reasons, have taught these men to live on a better scale than their equals in mental calibre in other lines. This factor should be taken into consideration in fixing the amount that should constitute a good living wage to them.

Wage fixing should be carried out along scientific lines. When the gas companies and other branches of industry appreciate this fact fully there will result a much greater return per man employed.

In justice it must be said that the gas industry is no more stinting as regards compensation of employees than are other industries. Perhaps it is even less so.

Many companies already fix their rates of compensation on the basis of a good comfortable living with an addition so the employees can set aside something to show for their work; in other words get ahead, and, every year, just so much nearer financial independence. The weakness of the structure is, however, that these companies do not really know how much it costs to live after the manner the employee would consider comfortable. Doubtless they would stoutly declare they do, and be sincere in the assertion, but upon being brought down to hard facts, would admit that their belief was founded on theory, or at best, very superficial knowledge.

This journal does not believe any one company, except, of course, companies in very large cities, would be justified in shoulderng the expense of the necessary investigations to obtain such definite knowledge. Were the cost of living not governed to so large an extent by local conditions we would state it was rather a matter to be handled best by the National associations. This factor of local conditions, however, takes it out of such hands and would seem to place it upon the local associations.

Whoever handles it, it is a matter of supreme importance. A hard and fast scale of what a decent living requires should be determined for every employee from the water boy up to the president of the company, and on this basis the rates of compensation should be worked up. The adoption of such a system on a sound basis would eliminate a very large amount of the troubles that now beset the industry.

Need of More Publicity

One who follows the advertising of different industries is often struck by the effect this advertising has on other industries. For years two manufacturers of phonographs have been large users of space in our national advertising mediums. At the recent convention of the piano trades, held in New York City, it developed that the piano business is just holding its own, and it was decided to raise $15,000 to start a musical educational propaganda. In other words, to advertise the music industry nationally.

Not so very long ago the coffee men discovered that the advertising of coffee substitutes was limiting the market for coffee. They are now considering the advisability of spending considerable money in national advertising.

The extensive advertising of smoking tobacco and cigarettes has resulted in a falling off of cigar sales. This fact may have been a contributory cause of the United Cigars Stores Company's starting a national advertising campaign on some of their brands of cigars.

In every field where one industry is given a great deal of publicity and another is given comparatively little, the one that is left in silence makes very slow progress in comparison with the one that is advertised. Its business may not actually fall off but it does not increase in volume as it should.

In the public utility field the rule still holds. Water supply, which in reality is a public utility, has been given so little publicity that it has now come pretty generally to be looked upon as a project to be handled by the municipal government. Gas supply has not sunk to this level, but it has never received the publicity it should have received.

One can hardly pick up a magazine without finding in it advertisements of electric appliances. Many manufacturers advertise quite extensively in national mediums. The electrical industry has a publicity organization which directs and acts as a clearing house for the activities of the individual firms. Its work is mainly educational in character.

In the gas industry there is not enough publicity. It is a mistake to think that silence adds dignity to the business. Is the President of the United States less dignified than the ruler of some South Sea Island simply because he receives more publicity? To-day public sentiment rules more supremely than ever before. The only way that this sentiment can be made favorable to the gas industry is to give the industry more publicity. To make the publicity effective it must be directed from some central body equipped with authority, talent and finance. This is being done in other industries. Will the gas industry follow suit?

Pressure Regulation

It has been stated that the inverted gas lamp has not proven the success it should have because it has not yet displaced the upright lamps. To this the lamp manufacturer can reply that it is the gas service rendered rather than the design of the lamp that has caused gas lamps to give any trouble they may have given. They can point out that gas companies change the kind of gas they are making from time to time, and allow a very considerable variation in the pressure at the burner, yet expect the gas lamp to still give perfect service. They can point out that electric companies never change from direct to alternating current, or from alternating to direct current on any part of their system without changing all the utensils on that system. They do not make changes regardless of the interest of the consumer in the same way that gas companies change from water gas to coal gas or from coal gas to water gas as fancy dictates. Electric companies endeavor not to let the pressure vary more than 5 per cent above or below normal. If the variation is much greater than this the lighting service is not satisfactory. For instance, if the pressure at the lamp is 110 volts this pressure must not fall far below 105 volts or go much above 115 volts or there will be complaints from the customers.

The gas man may say that it is not possible to supply such constant pressure with gas. Let us see what the electric man has accomplished. He cannot store his electricity. He has an equipment that as far as operation is concerned closely resembles a water gas set and relief holder, but with no storage holder. He must always be ready to tie in another generator and to do so requires more steam. He must feed directly into the lines the current as it is used and he must feed this current in at such a rate that the pressures at the ends of the lines will not vary more than 5 per cent above or below normal.

What he does is what the gas man would be doing if he generated water gas, had no storage holder, and, supposing the average pressure at the burner was 25 tenths, did not allow it to fall below 22 tenths or go above 28 tenths. There are few if any gas companies that keep the pressures at the utensils of all their consumers regulated so closely as this. Should this become the practice it is easy to see how much more satisfactory gas lighting would become. Under such circumstances all gas lamps could be made with fixed orifices and air shutters which would not admit of change by the consumer. The only work necessary for proper maintenance would be simply cleaning glassware and changing mantels. The average efficiency of gas lighting under actual operating conditions would also be considerably higher than it is at the present time.

It is not right for gas engineers and gas managers to say that this cannot be done. The question rather should be: Are the advantages to be derived from such services worth as much as the cost? Investigation along this line would surely result in closer pressure regulation if it did not result in such ideal regulation as has been pictured above.

Actual Operation Shows that As High a Per cent of Perfect Work in Japanning is Obtained from a Gas Oven as an Electric Oven

Homer T. Hood Describes Tests Made by Detroit Gas Company to Conclusively Demonstrate Merits of Two Fuels for Purpose Indicated—Indirect Type of Gas Ovens Used

HOMER T. HOOD

During the past year the electric interests have been making a strong bid for the japanning business, and, in order to conclusively demonstrate the merits of the two fuels to the various manufacturers, the Detroit City Gas Company built a number of experimental gas ovens which were operated under exactly the same conditions as the experimental electric ovens. In order to best meet the claims advanced for the electric ovens the indirect type of oven was used in the tests. In general either the construction used by Gehnrich of the Indirect Oven Company, of Brooklyn, N. Y., or that used by Young Brothers of Detroit, has been followed in the test ovens. In this type of oven the flames and products of combustion are completely excluded from the baking chamber. Homer T. Hood, in a paper presented at the recent annual convention of the Michigan Gas Association, discussed the tests as follows:

The tendency, at the present time, seems to be to bake at higher temperatures and in less time than formerly. In some cases this speed is carried to an extreme that threatens to destroy the quality of the work. It has been found that hard finish high temperature japans may be brought gradually to about 400 deg. Fahr. in 30 minutes.

It does not seem possible to bake in less time than this without causing a streaked surface because the japan starts to harden, while it is still running and dripping. If it is desired to apply the japan very thick, or if an extremely fine surface is desired, it may be necessary to raise the temperature a little slower.

This point, however, should be emphasized, that if great speed is desired it may be obtained with indirect gas equipment.

It is simply a question of the amount of heat to be applied, and hence, the amount of gas to be burned; this is in turn a question of burner design and the size of the combustion chambers.

We have found in all our experiments that the same amount of work can be turned out with gas as with electricity, if the proper gas equipment is installed.

Greatest Loss of Time Is in Loading and Unloading

As a rule the greatest loss of time is in loading and unloading. This is being overcome by the use of trucks, overhead trolleys, revolving shelves and continuous conveyors. Each job should be analyzed to determine the best equipment. Gas or electricity is not affected by the loading devices. Both may be used.

In the old type of direct heated gas ovens a certain amount of dust is brought into the oven by the air used for combustion. Also the japan vapors come in contact with flames and are scorched producing a small amount of fine soot. Naturally the oven is dirtier and the finish is not quite as bright and clean as that obtained in the electric oven or in the indirect gas oven. However, there can be no difference in the quality obtained in the indirect gas oven and in the electric oven, as the same kind of heat is obtained from a piece of metal, whether heated by a gas flame behind the metal or heated by an electric current.

The distribution of heat through the two ovens is practically the same. In large ovens equipped with side heaters only there is about 60 deg. temperature difference, between the hottest and coldest spots in either gas or electric oven. The hottest region is at the side near the top in the path of the hot air coming in from the heaters and coldest region is near the center of the oven between the work and near the floor.

Statements that the electric oven when heating shows only five degrees difference between the hottest and coldest parts are absolutely absurd.

Practically all the heat developed within the oven must be dissipated by the circulation of hot air. Only those pieces of work which are hung directly in front of the heaters receive heat by radiation as these pieces shield and protect those hung further back.

In narrow ovens, side heaters, or combustion boxes and tubes of the Gehnrich type are practical and easy to install.

If the ovens are over 8 to 10 ft. wide, in order to get the best distribution of heat, there should be a false floor in the bottom with the combustion boxes and burners underneath, so that the heat generated may pass up through the work in the most direct manner. This condition may be obtained in the Gehnrich type of oven and also in the oven that is built by Young Brothers of Detroit.

Actual operation shows just as high a per cent of perfect work is obtained from a gas oven as an electric oven.

Unless Carefully Operated Electric Oven is Exceedingly Unsafe

Originally it was claimed that an electric installation was absolutely safe, but gradually this view has been shifted until it is being accepted as a truth, that unless it is operated carefully it is exceedingly unsafe.

In all our experimental work we have found the indirect gas ovens to be safe, but not foolproof.

It is claimed of either oven that there is no temperature in the oven sufficient to start a fire and that a cup of japan may be thrown into the heaters without catching fire. This condition is more easily realized in the indirect gas oven than in the electric. The total radiating surface in the gas oven has in general been more than three times that in the electric oven, in fact in many ovens the upper half of the combustion boxes alone which is the hottest region in the gas oven, exposes a greater surface than all of the electric heaters. But even if the temperature of the electric heaters is normally low there is always the danger of an arc being caused by: A loose connection; a ribbon burning out; or a short circuit caused by a heater sagging or by a piece of wire or other piece of metal being accidentally dropped on to the heater.

The various japans contain about 85 per cent volatile oil, which is practically all driven off by the time the work has been heated to 275 deg. Fahr. In order to dilute this oil vapor so that it is no longer explosive it is necessary to pass about 10,000 cu. ft. of air per gallon of japan, through the oven during the period in which this vapor is coming off. In those cases where a truck load of freshly dipped work is placed in an oven already at a temperature of 400 deg. or higher we must be very generous with the ventilation during the first ten or fifteen minutes if we wish to remove all possibilities of an explosion. There have been a number of explosions in electric ovens because of insufficient ventilation.

Danger of Burner Going Out in Old Type of Oven

In the old type of direct oven there was always the danger of one burner going out, filling the oven with gas, and then being ignited from the other burner. In the indirect type where each burner is in a separate box or compartment there is no chance for the gas to become ignited from another burner should a burner go out. Then if an explosion should occur due to gross negligence, only a relatively small volume of gas explodes and the relief covers which are provided for just such an emergency will relieve the pressure and no material damage will be done.

We are now using high pressure atmospheric burners. Gas is furnished at a pressure of about one pound by means of a small gas booster and by-pass regulator. This eliminates all difficulties due to variable gas and air pressures. The noisy air relief from the blower is also eliminated. Only one pipe line is required, and only one valve is required per burner or per group of burners. Thermostats may be used without difficulty to regulate the heat. We have them in operation at the present time and they seem very reliable.

We have found that under the most favorable conditions for efficiency where a low temperature is maintained for a long time that 85 per cent of the gross heat of the gas is transmitted into the oven and under the most unfavorable conditions where a high

temperature is required quickly and then the oven is cooled at once so as to loose the heat stored up in the combustion boxes at least 65 per cent of the heat is transmitted into the oven. Or with a 600 B. t. u. gas, 6½ to 8½ cu. ft. are equivalent to 1 k. w. hr., and in general we are more than safe in figuring 8 cu. ft. per k. w. hr. If you have a gas installation and you wish to find out how much it would cost to use electricity under the same conditions simply divide the cu. ft. of gas used by eight, to find the number of kilowatt hours necessary to do the same work. Knowing the cost of gas and the cost of electricity in any particular case, the comparison may be found.

Under the most favorable conditions, the operating cost of an electric oven is at least twice that of gas in any place in Detroit, and under less favorable conditions, the cost may be four or five times that of gas per bake.

Life of Indirect Gas-Heated Equipment

The most favorable condition under which electricity may be used is a condition under which there is practically a uniform load which is carried both day and night. If japanning is done during intermittent periods or during day time alone, the cost per unit is greater.

In the case of gas, in most cases, where consumers have reached the minimum rate, the cost remains the same whether japanning is done a part of a day, or day and night. We have found that under the most favorable conditions, gas is one-half as expensive as electricity for japanning. And these ideal conditions are not of long duration and cannot be counted upon. In one of our experimental plants, we found that the gas would cost 60 cents per bake less than the electric oven under the most favorable conditions of continuous operation for the electric. Considering the electric ovens as being used in the day time alone, the saving per bake would be about $1.00 and then if the production would be cut in half, the saving would amount to about $1.75 per bake. The first cost of installation of the indirect gas equipment is seldom more than 1/2 to 2/3 that of electric equipment.

The life of the indirect gas heated equipment is not known, but indirect gas heated equipment has been made since 1911, and all of it is in use at the present time. We have given some installations very hard use without any of the equipment showing the least sign of deterioration.

The life of the electric heater seems to be about a year. In nearly all of the trial installations, the heaters have been replaced after a few months' use and in only few cases have the heaters been in use more than six months. At one place, which we have in mind, all of the heaters have been changed three times in less than a year.

No Corrosion on Gas Combustion Boxes

The gas combustion boxes are always too hot to allow any moisture to condense on them and consequently there is no corrosion. On the other hand, they are not hot enough to cause scaling. The lower combustion boxes are made out of ten gauge steel and consequently will have a long life, even though there was a corrosive action or scaling.

In view of these facts it is plain that an up to date indirect gas equipment has many advantages over electricity. But if a manufacturer is having trouble with an unsatisfactory gas equipment, the electric salesman will have little trouble in getting the business unless we are willing to demonstrate what can be done with the best gas equipment.

Automatic Lighter Essential to Satisfactory Gas Range

Every gas range should be equipped with an automatic lighter of the most convenient type, in the opinion of F. S. Wade, of the Southern Counties Gas Company, of Los Angeles, Cal. The fact that the present lighter is not entirely satisfactory should not in the least detract from our efforts to develop one that is wholly satisfactory and reliable. The future of the glass oven door is not yet quite certain, but there cannot be the slightest doubt that every oven should be equipped with a reliable thermometer. This last is the old question of rule of thumb against scientific accuracy—of "a good medium heat" against "250 deg. Fahr.," and as always scientific accuracy must win.

Brainerd Gas Works Serves 10,000 Population

The Brainerd Gas Works, the completion of which was noted on page 173 of the September 11 issue of the American Gas Light Journal, consists of American Gas Construction Company generating apparatus, with high pressure storage and medium high pressure delivery. A 10,000 cu. ft. relief holder was installed and high pressure storage tanks of 60,000 cu. ft. capacity. A Connersville high pressure blower is being used for blasting the water gas set, and Ingersoll-Rand's latest design of compressor for small gas works, fitted with their Rogler valves.

The plant is owned by the Light & Power Company of St. Cloud, Minn. H. G. Williams is general superintendent, and Jerome Spiering is local superintendent. Henry I. Lea, of Chicago, is engineer for the company.

Brainerd is a city of about 10,000 population, located about 125 miles north of Minneapolis.

Peoples Gas Light & Coke Takes Up "Combination" Gas and Coal Ranges

As is evidenced by the accompanying illustration, the Peoples Gas Light & Coke Company of Chicago has taken up the "Combination" gas and coal range. A particular interest attaches itself to this action of so large a company since, for some reason —biased opinion asserts that it is the same mistaken reasoning which in bygone days prompted some gas companies to bitterly oppose the introduction of the Welsbach lamp—the gas man in general has not accorded this type of range the support its advocates argue its merits entitled it to.

Would This Be Best For Your Home?

A Double Service Gas Range

Burns Gas

For everyday cooking requirements—with all the advantages and conveniences of the most perfect gas range.

Burns Coal

When the North wind blows a gale and nothing short of a coal fire will keep your kitchen warm and cozy.

YOU simply burn either fuel—gas or coal—as your needs and the weather dictate; or you can cook the foods you want quickly, on the gas fire, and foods you can wait for, on the coal-heated section—both at one and the same time.

These "Combination" Gas and Coal Ranges

are very practical and extremely popular in the thousands of homes where the heating equipment was not planned to take care of the kitchen.

We sell these Combination Ranges at low prices on easy monthly-payment terms at any of our branch stores or our big salesroom downtown.

If you cannot call to see them, just telephone or drop us a postal and we will send you our illustrated Range-booklet—"Cooking Wrinkles"—containing illustrations and descriptions of our complete line.

If you have a coal stove now in use in your kitchen (4 hole or larger) we will take it in exchange for a Combination Gas and Coal Range, allowing $5 on the purchase price.

The Peoples Gas Light & Coke Company

Peoples Gas Building Telephone Wabash 6000

Calorific Standard Tests are Giving Gas Companies Opportunity to Study Gas Making Characteristics from New Angles

The accompanying forms, herewith reproduced, are being used by gas companies in Massachusetts in connection with the investigation now going forward under the direction of the Gas & Electric Light Commissioners in the matter of establishing a calorific standard in that state.

Companies are required to make daily tests as formerly at the office and works, and from the weekly averages the form is filled up. Some companies test six days in the week only, while the practice of other companies is to test seven days, and the same practice is being continued, it being the Commission's desire not to upset established routine.

The tables presented herewith, and used by the companies in the same connection, were formulated in part by Chief Inspector Charles D. Jenkins, and are used in the test to correct results back to standard conditions.

In the course of their visits to the companies, the inspectors are finding some interesting conditions. One company producing a mixture of water and coal gas with oil was obtaining a 16-cp. gas with a large amount of oil. By reducing the amount of oil about 25 per cent a gas of 15.7 cp. was obtained. The conclusion arrived at was that too much oil had been used previously to be carried along by the gas.

Another company formerly putting out 16-cp. gas dropped its candlepower to 13 cp., and so far as is known the gas is giving equal satisfaction as formerly.

The tests and experiments conducted in connection with the investigation are giving Massachusetts gas companies opportunity to study gas making characteristics in a new way and from a different basis than before.

Form G. I. 21 1,000. 7-'16.

The Commonwealth of Massachusetts

BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS

TABLES FOR CALORIMETRIC CORRECTIONS

TABLE A

Table to reduce gas volumes to standard conditions, saturated gas at 30" barometer and 60° Fahrenheit

USE THE TABLE PUBLISHED BY THE BUREAU OF STANDARDS, THE AMERICAN METER COMPANY, AND OTHERS

TABLE B

Percentage of Humidity (Rapid Ventilation)

DRY BULB READING, DEGREES FAHRENHEIT

WET BULB READING	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
88																94
86															94	86
84														93	85	78
82													93	85	78	71
80												93	85	77	70	64
78											93	84	76	70	64	58
76										92	83	76	69	63	57	53
74									92	83	76	68	63	56	52	46
72								92	83	75	68	63	55	50	46	42
70							92	82	74	67	62	54	49	44	40	36
68						90	82	73	66	60	54	47	44	38	35	31
66					90	82	73	66	58	53	47	43	37	33	29	26
64				90	80	72	64	57	51	46	42	36	33	27	25	23
62			90	80	72	65	57	50	44	39	35	30	27	24	21	17
60		89	79	70	62	55	48	43	37	33	28	25	23	18	16	13
58	89	79	70	62	54	47	42	36	32	27	24	20	16	15	12	9
56	79	69	61	53	45	40	35	30	25	23	19	15	14	10		
54	69	60	52	45	38	33	27	24	20	16	13	10				
52	58	49	43	37	31	25	22	17	14	11						
50	49	41	35	30	23	20	15	12								

HUMIDITY

TABLE C

Corrections for Humidity in B. T. U.

PERCENTAGE OF HUMIDITY

ROOM TEMPERATURE	10%	20	30	40	50	60	70	80	90
60°	+4	+4	+3	+2	+2	+1	+1	0	0
65	+5	+4	+4	+3	+2	+2	+1	0	-1
70	+6	+5	+4	+3	+3	+2	+1	0	-1
75	+7	+6	+5	+4	+3	+2	+1	0	-1
80	+8	+7	+6	+5	+3	+2	+1	0	-1
85	+10	+9	+7	+6	+4	+3	+2	0	-1
90	+12	+10	+9	+7	+5	+4	+2	0	-2

THE EMERGENT STEM CORRECTION FOR THERMOMETERS WILL BE GIVEN BY THE INSPECTORS FOR EACH THERMOMETER

TABLE D

Conversion Inches Water into Inches Mercury

Inches Water	Inches Mercury
1.0	0.07
1.2	0.09
1.4	0.10
1.6	0.12
1.8	0.13
2.0	0.15
2.2	0.16
2.4	0.18
2.6	0.19
2.8	0.21
3.0	0.22
3.2	0.24
3.4	0.25
3.6	0.27
3.8	0.28
4.0	0.30
4.2	0.31
4.4	0.33
4.6	0.34
4.8	0.36
5.0	0.37
5.2	0.39
5.4	0.40
5.6	0.41
5.8	0.43
6.0	0.44
0.1	0.0074

Form G.I. 21. 1,000. 7-'16.

The Commonwealth of Massachusetts

CALORIFIC INVESTIGATION, WEEKLY REPORT

BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS

Company ... Six day period ending ... A.M. / P.M. ... 1916

COAL GAS

Gas made* per pound of coal

Kinds of coal used
Percentage of each

Analysis each cargo above coals
Date
Moisture — Ash
Volatile — Sulphur
Fixed carbon — B. T. U
Kind of carburetter used
Amount per hundred lbs. of coal

Lbs. coke per 100 lbs. coal
Gals. tar " " " "
Lbs. NH_3 " " " "
" " " "

B. T. U. gas, average
" " per lb. coal

Candle-power ... burner
Specific gravity

Analysis gas
Date
Illum. ... N_2
CH_4 ... O_2
H_2 ... CO_2
CO

WATER GAS

Gas made*†

Generator coal lbs. per M gas
" coke " " " "
Total fuel " " " "

Oil, gals. per M cu. ft. gas*

No. hours run, each machine
Tar, gals. per M cu. ft. gas

Kind of oil
Analysis of oil
Date
Spec. gravity
Distillation up to 100° C ... 200 – 250
100 – 150 ... 250 – 300
150 – 200 ... 300 – 330

B. T. U. gas, average
" " per gal. oil

Candle-power ... burner
Specific gravity

Analysis, or, if not complete, CO_2
Date
Illum. ... N_2
CH_4 ... O_2
H_2 ... CO_2
CO

COMMERCIAL GAS

	coal		water	% water
Amount gas made* total†				
B. T. U. at works,† average	max.	date	min.	date
B. T. U. testing station, average	max.	date	min.	date
B. T. U. State inspection†		date		

Candle-power, average ... at ... station, burner used

Gas analysis‡ ... State inspection† ... Total sulphur per 100 cu. ft.
Date ... average
Illum. ... N_2 ... max. and date
CH_4 ... O_2 ... min. and date
H_2 ... CO_2
CO ... Spec. gravity

REMARKS:

Signed

*All gas returns to be corrected to 30" bar. and 60° F., purified and metered. †Thousands and tenths; Sunday make excluded. ‡Adhere to schedule, if changed, note in remarks space. Do not fill in. †Average. If more than one

Output of Gasoline From Natural Gas in 1915 Shows Gain of Over 50 Per Cent

Statistics just completed under the supervision of J. D. Northrop, of the United States Geological Survey, show that the year 1915 was one of decided expansion for the casing-head gasoline industry. The quantity of raw gasoline extracted from natural gas and sold in that year amounted to 65,364,665 gal., a gain of 22,712,033 gal., or 53 per cent, over the quantity marketed in 1914. The average price received for the unblended product at the sources of production was 7.9 cents a gallon, and the market value of the entire output was $5,150,823, a gain of 0.6 cent in average unit price and $2,044,914, or 66 per cent, in total market value, compared with 1914.

The volume of natural gas utilized in the manufacture of this quantity of gasoline, exclusive of that recovered as drips from gas mains, is estimated at more than 24,000,000,000 cu. ft., and the average recovery of gasoline per thousand feet was 2.57 gal.

The number of plants for the manufacture of gasoline from natural gas increased from 386 at the beginning of 1915 to 414 at the end of the year, a gain of only 7 per cent, but the combined daily capacity of the plants increased from 179,353 to 232,336 gal., about 30 per cent, as a consequence of the fact that many of them operated during only a part of 1914.

The Handy Little Hot Water Heater

The value and the comfort of a hot water heater was called to the attention of the public in a very attractive manner by the Westchester Lighting Company of Yonkers, N. Y. In the background was a painted drop representing a seashore, and in front a pergola made of hot water coils, hung with wistaria. The floor was covered with lilac cloth, and in the centre of the window was shown an open hot water coil and a card said: "Sixty Gallons of Piping Hot Water for Ten Cents," and another: "Hot Water Makes Every Household Duty Easier, Every Hour More Enjoyable. A Gas Hot Water Heater Provides This Necessity Economically."

News of the Gas Industry

Chicago Company Offers Lower Rates to Consumers

The Peoples Gas Light and Coke Company of Chicago, has made an offer of new rates in its negotiations with the city, of 75 cents, 65 cents and 35 cents, which, it is said, will average 70½ cents per 1,000 cu. ft. This rate will be maintained for a period of five years.

The gas company also offers to take consumers into a profit-sharing form of partnership. Rebates under the profit-sharing plan, it is estimated, will amount to 2¼ cents per 1,000 cu. ft., bringing the price to domestic consumers to 68 1/3 cents.

Settlement of the $10,000,000-rebate suit brought by the city to recover overcharges during the last five years is proposed by the refunding of one-third of the excess charges in ten payments extending over five years. It is estimated that these repayments will exceed $3,000,000.

A sliding scale of rates, charging a primary rate of 75 cents for certain amounts of gas consumed monthly, 65 cents for further amounts and 35 cents for all gas used in excess of these specified amounts, is proposed. The offer provides for a minimum bill ranging from 75 cents to $1.20.

It is estimated the amount left for profit-sharing between the stockholders and gas consumers after deduction of the normal operating expenses, interest on bonds and 6 per cent on any new securities issued for new capital, will amount to $3,000,000 a year. Stockholders would receive 85 per cent of this in lieu of dividends on their stock and consumers 15 per cent. Consumers on this basis would receive approximately $450,000 a year.

The company also asks the city for permission to change the standard on which gas shall be manufactured from 22-candle-power to the heating power standard of 565 British thermo units per thousand cubic feet. This is a standard adopted by the state utilities commission.

The proposed refund in settlement of the $10,000,000 gas litigation would make it unnecessary for old gas bills to be dug up, and presented to the company.

Gas Developments at Wilson, N. C.

Fred C. Armbruster, for the past three years assistant superintendent of the Newport News and Hampton Railway, Gas and Electric Company, and formerly in the distribution department of the Rochester Railway & Light Company, of Rochester, N. Y., has assumed charge of Wilson's new public utility venture, the gas department. To date he has been successful in securing several hundred applications for gas service. He is preparing a selling campaign, effective the latter part of the month.

Construction work is well under way on the system, with practically 9 miles of main installed. This work is being done by the American Gas Construction Company, of Newton, Iowa, under the Tenney System of water gas manufacture and high pressure distribution. Wilson expects to place its plant in operation about the middle of December. Considerable interest is being manifested by its citizens inasmuch as this plant like its electric plant is owned and operated by the town.

Old Colony Gas Company's Output for Three Month Period Almost 5,000,000 Cu. Ft. More Than Last Year

The Old Colony Gas Company of Massachusetts reports an output, for the three months ending Sept. 30, of 27,257,000 cubic feet, as compared with 22,938,000 cubic feet for the same period of the previous year, an increase of over 18½ per cent.

Seek Well to Supply Water for Ohio School but get Free Heating and Illumination Instead

The Board of Education, at Damascus, Ohio, sank a 206-ft. well in search of pure water for the pupils of its high school. Instead of encountering water, gas sand was struck, and a sufficient flow of gas was obtained to light and heat the building.

Blackstone Valley Company to Assist at Fires

The Blackstone Valley Gas & Electric Company of Pawtucket, R. I., has put in effect a rule that upon an alarm of fire, a designated employee will at once respond and report to the chief engineer of the Fire Department, and be in readiness to shut off gas in case the interests of safety demand it.

Arlington Company Has Department Exclusively for Store Lighting

The Arlington (Mass.) Gas Light Compny is maintaining a service department which devotes its attention exclusively to store lighting.

Radical Reduction in Rates at Elkhart, Ind.

The price of gas at Elkhart, Ind., will be reduced from $1.25 per thousand cubic feet to 95 cents per thousand for 15,000, and a sliding scale of 85 cents for the next 20,000; 65 cents for the next 50,000; 55 cents for the next 100,000 and 50 cents for over 200,000 cu. ft. of gas, according to an agreement reached between city officials and officers of the local gas company on Sept. 27.

The State Public Service Commission has been notified of the agreement and the officials at Elkhart are awaiting its approval.

Charleston Company Reduces Rates Before Date Set by Council

A reduction in rates to $1 per thousand cubic feet will go into effect in Charleston, S. C., Nov. 1, in accordance with an ordinance of the City Council, ratified Nov. 15, 1912. The cut in the gas rate, which is being made despite the fact that almost every material necessary to the manufacture of artificial gas has increased since the time that the ruling was laid down, should have gone into effect Nov. 15. The action of the company in making the reduction a half month earlier was entirely voluntary.

Efforts to Place Gas Lamps in Salt Lake City's Streets Futile, Since City was Already Bound

Although the people of Salt Lake living in the various districts where the Utah Gas & Coke Company and the Welsbach Street Lighting Company placed sample street lights, express a preference for the gas lights, the city is so tied up by a long-time franchise with the local electric company that the City Commission is unable to grant even a portion of the street lighting contracts to the gas company. By a contract entered into when the city was governed by a Council, Salt Lake City, in consideration of certain yearly concessions from the light company, must grant the electric light corporation the entire contract, regardless of price.

This came out at a recent meeting of the City Commission when the Utah Gas & Coke Company tried to get the contract for furnishing 250 lights of 100 candle power at $20 a year. The representatives of the electric company maintained it gives the city $12,000 worth of concessions a year. It was that statement that gave A. W. Bingham of the Welsbach Company, though realizing that his efforts were futile, an opportunity to lay down to the commissioners a few telling facts.

"This 'giving away' of $12,000 worth of electricity each year, as they say, is like a man who buys a bartender a drink and the bartender buys back," was Mr. Bingham's comparison. "The customer pays 12½ cents for the saloon man's drink. The drink that the latter 'buys' costs nothing but a cent or two."

Mr. Bingham maintained that, while these concessions may cost $12,000 if bought by the city, they should be estimated at what they cost the producing company—only a few hundred dollars or so.

He pointed out that the 1½ per cent of the gas company's gross earnings, which would be given the city, would make a gift—in real money—of about $4,000 a year.

One of the commissioners questioned whether the gas price was really lower than that of the electric company.

"Yes, it certainly is," Mr. Bingham said, "but it doesn't make a bit of difference. If we tried to give you gas lights free we couldn't do it. You are bound, under that franchise, to take the electric company's bid."

The City Commissioners admitted this to be true, and "the city, for the next thirty-seven years—unless action is taken to get from under the franchise—must be under the thumb of the electricity corporation," according to the declaration of Charles M. Eyman, manager of the gas company.

District of Columbia Utilities Board Will Not Stay New Gas Rate

The Public Utilities Commission of the District of Columbia will not block the going into effect of the 75-cent gas rate ordered by Congress, pending completion of a valuation it is making of the gas company's property for rate-making purposes. The Washington Gas Light Company requested the commission to issue an order continuing in effect the present rate of 85 cents per thousand cubic feet for gas, at least until the completion of the valuation and the determination of the rate question by the commission. This the utilities board has refused to do.

In its appeal to the commission the company stated that the seventy-five-cent rate was passed "without notice to the company, without a hearing, without an inspection of the books of the company, or without an investigation as to whether we could manufacture and sell gas at the rate fixed by Congress, which rate is unfair, unreasonable and unjust to the company, and arbitrarily done."

The commission's interpretation of the act by Congress is that it does not infringe in any way on authority previously given the commission. In other words, if the valuation shows that the seventy-five-cent gas rate is too low or too high, the commission is of the opinion that it has the authority to establish a rate that will be fair to both company and consumers, and that will take the place of the congressional rate.

Thanksgiving Then and Now

A timely display that told more plainly than any printed advertisement could do the advantages of modern methods of heating and illumination was recently set forth by the Consolidated Gas and Electric Light Co., of Baltimore.

The first window showed an old colonial kitchen, with big brick fire place—picturesque, but very extravagant as regards practical use for the amount of fuel consumed.

Gas logs were used, beneath which was placed a red bulb, to give the appearance of a big wood fire. Old fashioned andirons were shown, and stretched in front of the fire place was a big bear skin, while in the corner was a spinning wheel.

The roof and walls of the room were of logs, with the bark left on, and the chinks filled with plaster. A Puritan hat and coat hung on the wall, and over the fireplace was a flint lock gun and powder horn. On the ledge above the fireplace were a row of red apples, a tobacco can, a long stem pipe, and a pewter mug. On a rude home-made table were a couple of candles. A neat framed sign stood on an easel.

The second window showed the modern way of preparing the turkey with the gas range. A small section of a kitchen was disclosed, with the door of the range open to show the turkey in the pan, while in an upper apartment where it could be kept hot, was a pie. A three-panel screen shut off the kitchen from the dining room, where the modern turkey is served.

Here was shown a table set with napery, cut glass and silver. In the centre was the big brown turkey of papier mache, while at the place where the mistress sat was an aluminum percolator.

The room was simply furnished, according to the dictates of sanitation. A rug in Oriental pattern covered the floor, and the four chairs were of oak, straight backs and leathered upholstered. Gas was used for illumination, the cut glass shades and rod being twined with red ribbons and sprays of autumn leaves. A card in this window said: "The Modern Way—the Gas Way—of Serving the Royal Bird. The Maximum of Light and Heat with the Minimum of Labor and Expense."

One Dollar Minimum Charge for Gas Sought by Pacific Company

The Pacific Gas & Electric Company has petitioned the State Railroad Commission to permit it to impose a minimum gas charge of $1. The company stated that the gas cost $1.38 for the first 600 cu. ft. supplied the customer, who at the present pays a flat rate of 50 cents for that amount, and contended that the $1 minimum should be established.

Maine Commission Rules on Gas Company's Books Being Subjected to Investigation

At a hearing on the question of rates charged by the Lewiston (Me.) Gas Light Company, Oct. 2, the complainants' motion that the company furnish them with all its books and papers was heard by the Maine Public Utilities Commission. The motion specified all bills, vouchers and contracts for supplies, materials and construction; records of pipe, mains and services bought, in use and discarded yearly; records of operation, showing coal, oil and other materials used; main orders showing cost of extensions; records of directors' and stockholders' meetings, and account books, including journals, ledgers, cash books or day books covering the year's business.

Wallace H., and Charles B. Carter appeared for the company and pointed out that it would be unfair to give the complainants all the company's books and papers, because they would thereby have access to many things irrelevant to the case. They said the company would submit any papers having a direct bearing on the case, and that the petitioner's expert, Alton D. Adams, of Boston, had not been refused any documents that he had asked for specfically. The current business of the company would be greatly impeded, they said, were Mr. Adams to have free course among the company's records.

Counsel called attention to the section of the Public Utilities Act which specifies that any person inspecting a corporations' papers shall divulge their contents to no one except the commissioners, and said that the request is in violation of their provision, as Mr. Adams' information would be imparted to the complainants' counsel.

Chairman Cleaves of the Commission announced that there is no question of the Commission's authority under the law to require companies to submit their books up to certain limits, and in this case it will order the company to submit its books, under certain restrictions. Whether the records of directors' and stockholders' meetings will be included has not yet been determined.

Maine Commission Indorses Ready-to-Serve Charges

The Maine Public Utility Commisson endorsed the "readiness-to-serve" principle as being a sufficient argument for a public service company charging higher rates for service to summer-resort customers than to all-the-year takers of its product, in an important decision rendered, Sept. 28, in the case of the Bar Harbor & Union River Power Company. Here customers in the Mt. Desert Island summer resort region complained because they were required to pay 25 cents as compared with 15 cents per kilowatt hour for electricity, the latter rate being for all-the-year use.

The Commission, discussing the principle involved, said: "The water, electric or gas plant (at summer-resort communities) is constructed capable of supplying the demand during the period of seasonal use. The capital invested, depreciation, normal maintenance, insurance, all of these charges which go on whether a greater or a less amount of the product is consumed, are required as much for the premises which are regularly occupied during some part of each year, and must be served when occupied, as for those places which are open and supplied throughout the year. It is the 'readiness-to-serve' element.

"If it costs more per unit to serve the summer customer, the latter should pay more per unit for the service. Otherwise the added cost would be shifted to the yearly user."

The Commission held that the company's excess summer price, 66 2/3 per cent more than the all-the-year price, is not unjust nor discriminatory.

Hamilton, Ohio, Gas Plant Passes On to the Junk Dealer

Hamilton, Ohio's municipal gas plant is now almost a thing of the past; nothing remaining but the shell of the old gas holder. Several months ago the City Council authorized the Department of Public Service to dispose of the plant, which fell into disuse after the city acquired a natural gas supply. Gradually the plant was going to decay. It was then disposed of as junk, nothing being retained but the old gas house, which is being used as a store-room for the Department of Public Service.

The work of dismantling the plant has been going on for some time and all that remains, as has been stated, is the shell of the holder, which will be taken down within the next few days.

Hamilton, at one time, was the owner of the best artificial gas plants in the Central States. It was built as a municipal concern, and, through it, the cost of artificial gas in Hamilton was reduced to 80 cents per thousand cubic feet. It was operated for over 20 years, and during that time saved the people of the city thousands of dollars.

Gas Water-Heating Featured by Boston Company

The Boston Consolidated Gas Company has followed up its effective display advertisement in Boston newspapers, pointing out the advantages of gas for heating (a reproduction of which was published in the AMERICAN GAS LIGHT JOURNAL of Oct. 2), with another forceful quarter-page advertisement which describes recent tests of an ordinary gas water-heater attached to the kitchen boiler. Starting with cold water at 44 deg., at the end of five minutes, 2.83 gal. were drawn at 115 deg. temperature, and after 20 minutes, 18.5 gal. were drawn, at 104 deg.

In the heater referred to, which is carried in stock at the company's appliance store, the water is heated at the top of the boiler, giving results promptly.

Backfiring of Flame in System Employing Surface Combustion Principle Prevented by Producing Flameless Combustion of Part of Mixture Before It Reaches Flame

Backfiring of the flame is prevented in a new flameless combustion system employing the surface combustion principle on which a patent was recently granted C. Knox Harding, of 6320 Stony Island Ave., Chicago, by passing the mixture in contact with a catalytic structure and producing flameless combustion of part of the mixture before it reaches the flame, thus reducing the calorific value and inflammability of the partially burned mixture, so that the speed of back propagation of flame in the mixture is reduced to a point where it is less than the velocity which can be produced by the injector action of bunsen burners supplied with gas at ordinary delivery pressure. The mixture, after passing the catalytic structure being a complete self-burning surface combustion mixture, can be quickly inflamed and burned with a flame in any closed space and in contact with solid surfaces.

The process employs catalytic flameless combustion and enables the most explosive mixture of gas and air to be produced and burned continuously and non-explosively.

The object of the invention is to provide an improved catalytic structure for use similar to that in apparatus in which heat is procured by causing combustion of a moving current of a combustible gaseous mixture, localized by contact with the solid catalytic structures and maintaining contact combustion as distinguished from flame combustion by the absence of flame.

In maintaining flame combustion, it is stated, the conditions are limited by the character and velocity of the flowing combustible mixtures, and partial combustion cannot be effected with an ignited mixture, because the velocity of flame propagation varies over a wide range with different combustible mixtures, and its rate of propagation is generally much less than the rate at which catalytic combustion takes place, which is almost independent of both the rate of propagation and the velocity of flow of the combustible mixture, and this flameless combustion therefore may be maintained in contact with heated catalytic bodies when the velocity of flow of the mixture is many times as great as would permit of flame combustion.

Catalytic structures composed of the refractory oxids of elements of low specific heat and high atomic weight, such as thorium or mixtures of thorium and uranium, have properties which peculiarly fit them for use in apparatus for producing catalytic combustion without inflaming the mixture. It is presumed that because these elements are among those having the fewest and largest molecules for a given weight, a less quantity of heat units serves to produce a much greater intensity of temperature. Their radio active properties, or radio active properties of other elements commonly associated with them, may contribute to the advantages found in connection with their use for catalytic structures to produce combustion without inflaming the gaseous combustible.

Baby Contests Effective in Attracting Readers to Gas Company's House Organ

For a long time George W. Allen, advertising manager of the Consumers Gas Company of Toronto, Ont., has been conducting a baby contest in the company's *Gas News* for the purpose of attracting their parents to the pages of the publication. There are no restrictions of any kind, and every contestant receives some reminder of the event. In the last contest 131 baby photographs were received, 19 of which were passed for first prize, 15 for second prize, and the remainder received tokens of appreciation.

Nearly 500 children entered the missing word contest advertised in the April issue of *Gas News*, and 25 prizes were given including gas irons, C. E.-Z. lights, toasters, etc. The other children each received a souvenir penholder.

A great interest has been taken in these absolutely free contests, and it has been a great help in getting the parents to read the publication.

Charter Granted Crisfield Leaves Utilities in Uncertain Position

In the 1910 session of the Maryland Legislature, a public service commission was created with powers to regulate the rates of public service corporations throughout the state, revoking all laws of the statute books pertaining thereto, and giving the service commission exclusive control.

A few days later in the same year the Legislature granted a charter to the city of Crisfield in which the city was granted the right to regulate the rates of all public service corporations in that city.

The gas company has followed the instructions and laws of the State Public Service Commission, and has had no opportunity to test the conflicting laws.

The electric light company also is working under the State authority, and the telephone company is desirous of so doing, but the city authorities, in its case, have asserted their right to determine the charges to be paid in the city.

The Crisfield Light & Power Company, of which R. G. Anklam is manager, is greatly interested in the outcome of this difference between the telephone company and the city as, if it is ever compelled to ask for any change in rates, it feels it must expect a lawsuit with the city officials to find out whether it will have to obey the Public Service Commission or obey the mayor and council.

Gas Meeters Section Organized at Dayton, Ohio

More than 100 employees of the Dayton Gas Company have organized into a Gas Meeters Section, and have made plans for future activities. The officers elected were as follows: President, W. H. Young; vice-president, W. H. Harris; secretary, T. H. McCabe; treasurer, W. C. Broad.

Personal Notes

J. NEWTON HARDY, formerly of Richmond, Va., has been appointed cashier for the Consumers Gas & Coke Company of Waycross, Ga.

W. W. FENNER, formerly connected with the Trinidad Electric Transmission Railway & Gas Company, of Trinidad, Col., has been appointed manager of the Trinidad company's office at Walsenburg, succeeding W. R. Shade.

ROBERT FOSTER has been appointed to have charge of the gas producer plant for the Farnam-Cheshire Lime Company of Cheshire, Mass.

WILLIAM H. RICHARDSON, for the past eight years cashier of the Brattleboro branch of the Twin State Gas & Electric Company, has been appointed manager of that branch, succeeding E. M. Addis, resigned.

ALBERT C. GOODNOW, formerly assistant general manager of the North Shore Gas Company, of Waukegan, Ill., has been appointed general manager of the system, succeeding his father, G. F. Goodnow, who has been appointed to the office of vice-president of the company.

H. D. MITCHELL has resigned from the office of manager of the Menomonie (Wis.) Gas Company to accept a position with the Welsbach Company at St. Paul, Minn.

J. H. DAWES, formerly manager of the Iron Mountain Light & Fuel Company, has been appointed manager of the Menomonie Gas Company, succeeding H. D. Mitchell, whose resignation is noted elsewhere in these columns.

W. B. MISER has been appointed manager of the newly created commercial department of the McKinley Company at Champaign, Ill.

C. D. BOND has been appointed special agent for the Old Colony Gas Company, in connection with the domestic science lectures which has been undertaken by that company at Whitman, Mass.

EDWARD J. CHENEY, formerly of Schenectady, N. Y., has been promoted to be chief of the division of light, heat and power of the New York Public Service Commission for the Second District. Mr. Cheney succeeds Edward McGuire of Buffalo, who has resigned from the service and returned to Buffalo to engage in private business. Mr. Cheney has for four years been assistant chief of the division which he now heads. He is a graduate of the University of Minnesota, class of 1904, and was a member of the engineering staff of the General Electric Company of Schenectady, N. Y., before entering the employ of the Public Service Commission.

DONALD MCDONALD, manager of the Louisville Gas & Electric Company, has been elected a director of the Louisville Industrial Foundation and has been appointed vice-president by the board.

W. D. BIRBECK has accepted the position of engineer of construction with the Indiana Fuel & Light Company, of Auburn, Garrett and Kendallville, Ind., with headquarters at Auburn. Mr. Birbeck, previously, was connected with the sales department of the Western Gas Construction Company.

S. C. BRATTON, commercial manager of the Portland Gas & Coke Company, addressed the N. E. L. A. section of the Pacific Gas & Electric Company, Sept. 26, on the subject of "Up-to-the-Minute Selling Methods," his paper on which was awarded the gold medal by the Pacific Coast Gas Association.

D. C. GREEN, formerly connected with the organization of H. M. Byllesby & Company as local manager at two Oregon and Washington properties, was appointed general manager of the Fort Smith Light & Traction Company, Fort Smith, Ark., September 26, succeeding H. C. Hoagland, who has been managing that property in connection with his work as manager of the Muskogee Gas & Electric Company for some time past. Mr. Hoagland will continue as manager of the Muskogee Gas & Electric Company.

H. M. CRAWFORD, formerly connected with the San Joaquin Light & Power Corporation at Bakersfield, has been appointed sales supervisor for the Pacific Gas & Electric Company in their Marin and Sonoma county districts.

M. V. GRAMMER AND L. L. KESLER, who have been connected with the commercial department of the Colorado Springs Light, Heat & Power Company during July and August, have returned to their former positions with the Citizens Gas & Fuel Company at Terre Haute.

GEORGE W. BIXLER, of the Denver Gas & Electric Light Company, who was active in the Denver clean-up campaign, has been appointed to the committee of the National Clean-up and Paint-up Committee Convention to be held at Atlantic City, October 9 to 12.

HUGH M. NELSON has been appointed works superintendent of the St. Louis Gas Company, of St. Louis, Mo., succeeding George S. Hessenbruch, whose resignation to enter practice as consulting engineer was noted in these columns some weeks ago.

E. M. ADDIS, for seven years manager of the Brattleboro, Vt., division of the Twin State Gas & Electric Company has resigned, and on Nov. 1 will assume the managership of the Wallingford (Conn.) Gas Company.

Societies and Associations

THE NEW YORK SECTION OF GAS METERS will hold its first get-together for the year 1916-1917 at Pabst Harlem, 256-258 West 125 Street, New York City, at 6.30 p. m., Oct. 19. Edwin T. Barclay, of 109 W. 111 St., is secretary-treasurer of the section.

THE PACIFIC COAST GAS ASSOCIATION elected the following officers for the forthcoming year at its recent annual convention: President, C. B. Babcock, General Gas Light Company, San Francisco, Cal.; vice-president, J. D. Kuster, Pacific Gas & Electric Company, San Jose, Cal.; secretary and treasurer, Henry Bostwick, Pacific Gas & Electric Company, San Francisco, Cal.; directors, F. S. Wade, S. Waldo Coleman, H. W. Jackson, C. A. Luckenback, John A. Britton, Z. T. Bell and Leon B. Jones.

Construction Notes

Manufacturers to Co-Operate in Sale and Construction of National Chamber Oven Plants

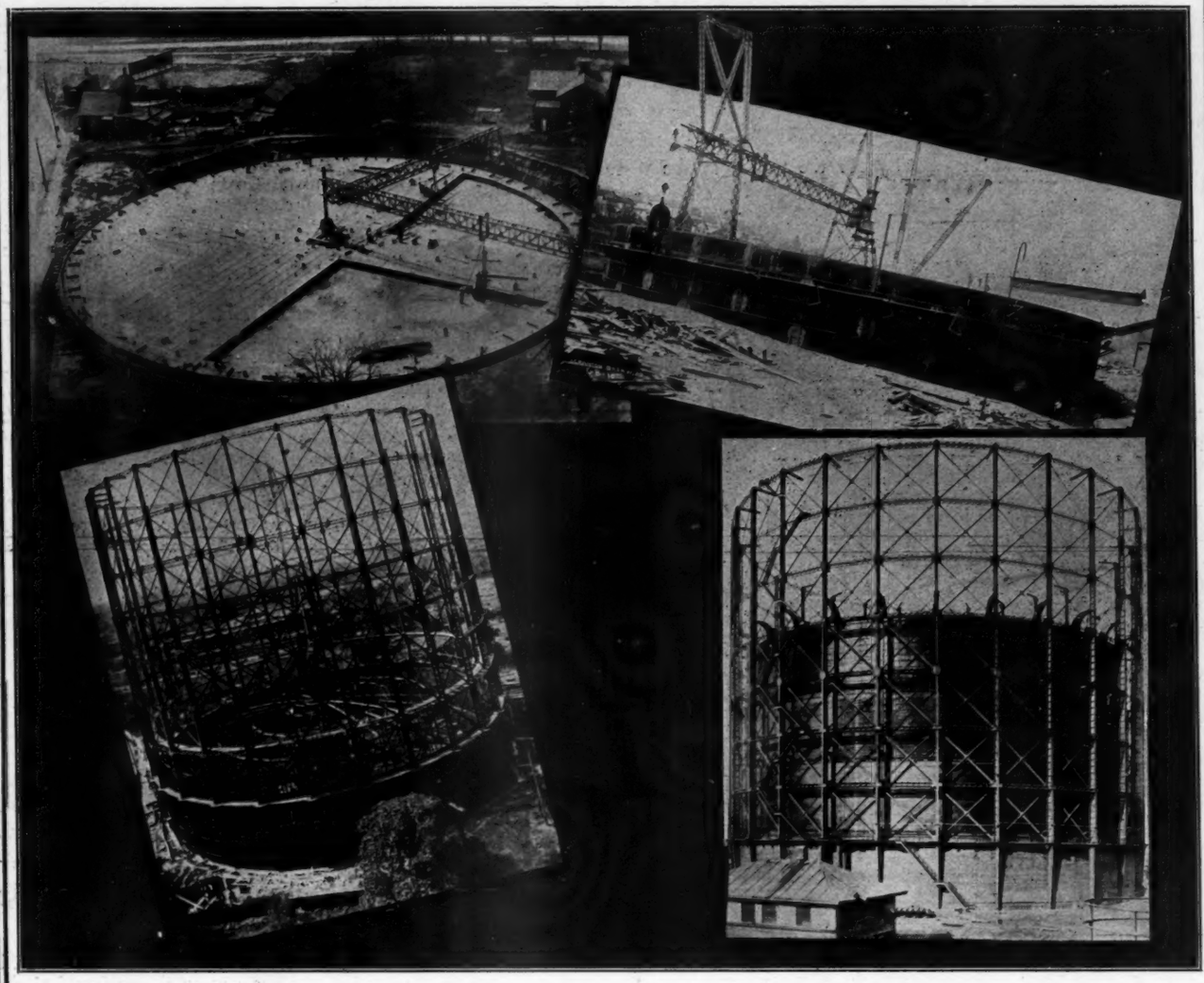
An agreement has been entered into by the National Chamber Oven Company of Cincinnati, the Stacey Brothers Gas Construction Company of Cincinnati, and the Russell Engineering Company of Saint Louis, whereby the companies will, in the future, co-operate in the sale and construction of National Chamber Oven Plants in the United States, Canada and Mexico.

Additions to Properties of Pacific Gas & Electric Company Authorized

The following additions and betterments of the properties of the Pacific Gas & Electric Company of California have been authorized.

Extension of 4-in. tubing on Davis Street from Clark Street to East Fourteenth; extension of 6-in main on East Fourteenth Street to San Leandro Creek, and 6-in main on East Fourteenth Street from Estudillo Avenue to Estabrook, and on Saunders south to Washington Street in Alameda County at a cost of $9,963.00. Also in the same county extension to 4-in. main on Ward Street from California Street to east line on California and the laying of a 2-in. main in the district of Asby, University, Lowell and Grove Streets at the cost of $6,942.00; the extension of a 4-n. main in Forty-Second Street west from Broadway to Webster, and in

(Continued on Page 18 of Adv. Section)



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Construction Notes, continued from page 256

Webster from Rich Street to Forty-Third Street at a cost of $5,288.00. The installation of 5,800 feet of 4-in. pipe from the compressor station to governor pit on Main Street in Petaluma, has been authorzed at a cost of $3,060, the installation of a 7-in. main on bridge over Feather River between Maryville and Yuba at a cost of $1,810.00; the moving of 1,100 horsepower Heine boilers from Station "A" to boiler room of Potrero Gas Works, including the dismantling of obsolete units and necessary changes in pipe and flue connections and the installation of a common stack to provide additional boiler capacity for the works, at the cost of $29,600.00.

RIVERSIDE, CAL.—Permission has been granted the Banning Gas & Lighting Company by the board of supervisors to lay gas pipes along the highway from Banning to Beaumont.

BALTIMORE, MD.—Consolidated Gas, Electric Light and Power Company, Liberty and Lexington St., let contract for 4-story plant to Bennett Building Company, 123 South Howard St. Estimated cost, $35,000.

FRAMINGHAM, MASS.—The Framingham Gas, Fuel & Power Company has petitioned for permission to open Hollis Street for the purpose of laying a 4-in. gas main on the easterly side of the street.

BOZEMAN, MONT.—Robert W. Lysle, representative of Chicago interests, is in the city investigating the prospects for establishing an artificial gas plant in this city.

CHARLOTTE, N. C.—The Charlotte Gas Department is preparing to lay an additional 10-in. gas main along the line of East Morehead Street extension connecting the lines now in operation in Dilworth with the lines serving Myers Park. This work is now under way to the extent of assembling the material, and as soon as the bridge over the creek between Myers Park and Dilworth is completed the main will be put into place. The new line will tie into the system at the Dilworth city school on the west, and will follow the new street line across the valley and into Myers Park, connecting with the mains on Queen's Road at Stop 11. This extension will allow the company to serve all possible customers in this new territory for years to come and the new main is being laid at this time to avoid digging up this new street when the line becomes a necessity.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,198,425: MEANS FOR TESTING METERS. Richard L. Dezendorf, Richmond Hill, N. Y.

1,198,617: FLUID-METER. Horace Chrisman, Edgewood Park, Pa., assignor to Pittsburgh Meter Co.

1,198,907: GAS-STOVE. Edward G. Germer, Erie, Pa., assignor to Germer Stove Co., same place.

1,198,908: GAS-STOVE. Edward G. Germer, Erie, Pa.

1,199,130: GAS-BURNER. William K. Twomey, Chicago, Ill.

1,199,632: MEANS FOR DISCHARGING VERTICAL GAS-RETORTS. Herbert J. Toogood, Elland, England.

1,199,842: GAS-STOVE. James H. Walker, Milwaukee, Wis., assignor to The Fuller-Warren Co., same place.

1,200,078: GAS-BURNER. John F. Chambers, Shelbyville, and James M. Martin, Indianapolis, Ind., assignors to Chambers Mfg. Co., Shelbyville.

1,200,385: GAS-STOVE AND BURNER LIGHTING DEVICE. Lucien A. Marsh, San Francisco, Cal.

1,200,442: PROCESS AND APPARATUS FOR REMOVING TAR AND OTHER CONDENSABLES FROM GAS. Walter C. Dayton, Buffalo, N. Y., assignor to George H. Smith, trustee, same place.

Financial Notes

THE CONSUMERS' POWER COMPANY reports for August gross earnings aggregating $367,352; net $197,655; balance after charges and preferred dividends $61,769. For twelve months ended August 31, gross was $4,458,172; net $2,829,181; balance $1,168,440.

THE NORTHERN STATES POWER COMPANY reports gross earnings for August amounting to $443,982; increase $66,639; net after taxes, $228,098; increase $30,360. Twelve months' gross, $5,744,706, increase $875,944; net after taxes, $3,201,097, increase $506,369.

THE UNITED GAS & ELECTRIC COMPANY'S total income from all sources for twelve months ended Aug. 31, was $1,422,386, from which were deducted $492,204, interest on U. G. & E. bonds, $42,000 amortization and $649,936 dividends on first preferred stock, leaving balance of $238,247.

THE WISCONSIN EDISON COMPANY reports for August gross sales amounting to $830,203, increase 17 per cent; net $300,346, increase 16 per cent; balance $164,937, increase 36 per cent. Twelve months' gross $9,707,962, increase 14 per cent; net $3,971,905, increase 16 per cent; balance available for depreciation and for Wisconsin Edison Company, $2,367,212, increase 32.3 per cent. Balance was equivalent to $4.31 a share on stock, compared with $2.53 in previous twelve months.

THE PUBLIC SERVICE CORPORATION OF NORTHERN ILLINOIS, has declared a quarterly dividend of 1¾ on common stock, placing issue of 7 per cent annual basis, compared with former 6 per cent rate.

The UNITED LIGHT & RAILWAYS' report for the year ended August, 1916, showed the largest earnings in the company's history. Gross of subsidiaries increased 9.5 per cent, and net 12.4 per cent, with increase of 24.7 per cent in combined surplus. Earnings equivalent to better than 8 per cent on common stock.

THE PACIFIC GAS & ELECTRIC COMPANY'S stock sales department is offering a small block of the first preferred stock at 92½.

THE INTERMOUNTAIN RAILWAY, LIGHT & POWER COMPANY reports, for twelve months ended August, 1916, gross revenue, $208,332, against $153,230 in previous year; net, $93,990, against $62,979; balance after charges, $43,547, against $29,764.

THE EASTERN SHORE GAS & ELECTRIC COMPANY has declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable Sept. 27 to stock of record Sept. 18.

THE ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER COMPANY has executed its first and refunding mortgage for $15,000,000 to the Bankers' Trust Company and the Mississippi Valley Trust Company as trustees.

THE NEWPORT NEWS & HAMPTON RAILWAY, GAS & ELECTRIC COMPANY reports gross returns for August amounting to $100,877, increase, $7,412; net, $45,669, increase, $3,035; surplus after charges, $26,250, increase, $2,835. Eight months' gross, $678,628, increase, $86,451; net after taxes, $263,124, increase, $29,506; surplus after charges, $110,374, increase, $31,083.

PUGET SOUND TRACTION LIGHT & POWER COMPANY reports gross earnings for July aggregating $663,746, decrease, $818; surplus after charges, $60,872, decrease, $20,014. Twelve months' gross, $7,709,641, decrease, $136,947; surplus after charges, $553,138, decrease, $333,221.

THE NORTHERN OHIO TRACTION & LIGHT COMPANY reports gross returns for August aggregating $473,434, against $360,054 in August, 1915; net, $182,130, against $145,495; balance after interest charges and preferred stock dividends, $111,135, against $75,797 last year. From Jan. 1 gross aggregated $3,334,077, against $2,488,442 in corresponding period of 1915, with balance after interest and dividends of $711,081, against $408,263.

THE UNION ELECTRIC LIGHT & POWER COMPANY has been granted permission by the Missouri Public Service Commission to issue $921,000 25-year 5 per cent gold bonds.